Man
Econ dev
gov bd

Proceedings of a Seminar
Sponsored by the Manitoba
Economic Development
Advisory Board and the
Manitoba Research Council
Winnipeg 1977

Business Opportunities in a Conserver Society

HC
117
C13

LEGISLATIVE LIBRARY
CATALOGUED
NOV 1977
WITHDRAWN

BUSINESS OPPORTUNITIES IN A CONSERVER SOCIETY

HC 120 P76 M3
1977 c.1

PROCEEDINGS OF A SEMINAR SPONSORED
BY THE MANITOBA ECONOMIC DEVELOPMENT
ADVISORY BOARD
AND THE MANITOBA RESEARCH COUNCIL

COMPILED AND EDITED BY
GREG MASON AND
JOHN MCGUIRE
OF THE ECONOMIC DEVELOPMENT ADVISORY
BOARD

WINNIPEG, APRIL 1977

LEGISLATIVE LIBRARY OF ONTARIO
TORONTO
OCT 26 1977
RECEIVED

Gift: Man Econcouncil
Discard 69

101-06291/

The Economic Development Advisory Board, established in 1969, serves as an independent channel of communication between the government and the various institutions of the private sector. The Board members are therefore selected from this latter group to ensure that the viewpoints of the various interests concerned with economic development are presented to policy-makers in Cabinet. Specifically, the Board has a responsibility to enquire into "how best to stimulate and co-ordinate public and private activities in the field of economic development in the province" and also to "recommend any measures considered necessary to achieve the most effective means of communication between government departments and agencies and industries." The Board reports directly to the Minister of Industry and Commerce, the Hon. Leonard S. Evans.

Members of the Economic Development Advisory Board are:

- Mr. Leonard Remis:	Chairman
- Mr. Albert Cerilli:	Representative, Canadian Brotherhood of Railway Transport and General Workers
- Mr. Clyde R. McBain:	President, Ancast Industries Ltd.
- Dr. Paul Phillips:	Associate Professor of Economics University of Manitoba
- Mr. William E. Shields:	Vice-President, The Clarkson Company Limited
- Dr. Om P. Tangri:	Professor of Agricultural Economics, University of Manitoba
- Mr. Lewis D. Whitehead:	Publisher and Editor of the Brandon Sun

ECONOMIC DEVELOPMENT ADVISORY BOARD
411 - 428 Portage Avenue
Winnipeg, Manitoba
R3C OE2

C O N T E N T S

Page

PREFACE vii

PAPERS AND PROCEEDINGS

1. WELCOME AND INTRODUCTION 1

Mr. Leonard Remis
Chairman
Economic Development Advisory Board

2. TOWARD A CONSERVER SOCIETY 4

Dr. Josef Kates
Chairman
Science Council of Canada

Discussion 24

3. SOURCES, AVAILABILITY AND COSTS
OF FUTURE ENERGY 38

Mr. Robert G. Hart
Vice President
Atomic Energy of Canada Ltd.

Discussion 68

4. CANADIAN FOOD PRODUCTION:
FUTURE CAPACITY AND ADJUSTMENT 81

Professor Leonard B. Siemens
Associate Dean
Faculty of Agriculture
University of Manitoba

Discussion 105

5. LUNCHEON ADDRESS

Premier E. S. Schreyer 113

6. GOVERNMENT ECONOMIC DEVELOPMENT
STRATEGY: THE P.E.I. EXPERIMENT 126

Mr. Andy Wells
Man and Resource Institute
Prince Edward Island

Discussion 146

7. NOT GLOOM AND DOOM BUT PROFIT AND
BOOM IN A CONSERVER SOCIETY 153

Dr. J. Graham Smith
Professor of Management
McGill University, and
Associate Director of the
GAMMA Group

8. SUMMARY COMMENTS 180

Mr. John McGuire
Research Director and
Executive Secretary
Economic Development Advisory Board

APPENDIX

List of Delegates in Attendance 190

PREFACE

MANITOBA

OFFICE OF THE PREMIER

WINNIPEG
R3C 0V8

Energy and resources are critical to our economic well being. The Industrial Revolution first proceeded on a coal economy: now oil and electricity form the basis for our technology and soon, perhaps, nuclear power will assume an important role in fulfilling the energy requirements of North America. One thing is certain; the era of cheap abundant energy is gone and we must seek new methods of production, new patterns of consumption and a new approach to life if we are not to damage irreparably this finite and fragile planet. The Conserver Society movement calls our attention to the pressing problems posed by environmental degradation and unlimited resource extraction.

Society always benefits from informed opinion during times of stress and we are fortunate indeed that so eminent a group of experts was able to spend a day with us and present their thoughts, not only on the negative but also the positive aspects of conservation. Assuredly there is diversity in their prescriptions; however I am pleased to see that throughout their papers and the conference proceedings runs a clear thread of social concern. The management of the energy crisis in a way that does not alter the distribution of income in favour of a few is one of the pressing problems facing modern democratic society. Close cooperation between government and industry will be required if the transition to a less energy intensive society is to be made with fairness and justice to all.

I am pleased to endorse the Economic Development Advisory Board's seminar on "Business Opportunities in a Conserver Society" and I am delighted to see the papers and proceedings in print for distribution to a wider audience. I congratulate the Board and all those associated with the seminar and the preparation of this document for a job well done.

Edward Schreyer

1.

INTRODUCTION

Mr. Leonard Remis
Chairman
Economic Development
Advisory Board

Good morning ladies and gentlemen. On behalf of the Economic Development Advisory Board and the Manitoba Research Council, joint sponsors of this seminar, I welcome you all to what I think will be a most interesting and stimulating day.

As we perceive the economic scene, Canada - and for that matter the entire world - is in a period of great change. The major indicator of this change is that since 1973 there has been a rapidly rising trend in the prices for energy of all types. There is a growing awareness of this change and there is no turning back. People, even those who are modestly affluent and who could afford it are beginning to become aware of the changes on a personal level as such things as heating and gasoline bills are increasingly taking a larger proportion of their disposable income.

Nevertheless there is still a great deal of scepticism in the public mind about the reality of this crisis. I think it is symptomatic that President Carter and his Administration have found it necessary to pull out all the stops to bring home to the people of the United States the full realization that they are in a situation of very serious proportions. President Carter has managed to mobilize somehow, most of the mass media including television, radio and the major popular publications such as Time and Newsweek and has crowned this activity by a personal appearance before Congress. Much of the scepticism, no doubt

derives from the fact that many people are suspicious that this so called energy crisis is nothing but a great rip-off by the oil interests of the world. However, in the minds of most people is the belief that even if the crisis is due to a real shortage there is still nothing to really worry about for science and technology will come to the rescue; it always has in the past. In the past couple of hundred years science and technology has moved us first from a wood economy to a coal economy and then to a gas and oil economy. Surely, it is argued, we have the intelligence and the ability to pull ourselves out of this crisis. We, the general public, tend to maintain this label despite the warnings we are getting from the science and technology community. Changes take time they tell us and our resources may not be adequate to these changes. A certain amount of belt tightening and sacrifice is needed now. Yet I do not think the mood of the public at the moment is such that it is ready to accept such sacrifices.

Part of the reason, no doubt, is the fact that the question of which road we should take has not been answered. In fact, the debate is increasing with an increasing crescendo from all sides. There are advocates for stepping up the rate of exploration to find areas such as the tar sands and off shore reservoirs. There are advocates for expanding the number of nuclear plants and for finding new sources of energy in such as solar, wind and tide, and there are advocates for many forms of conservation practices.

It seems that conservation is now emerging as one of the most viable alternatives. However, the public is not accepting this alternative without some concern. Conservation suggests the slowing down of economic growth and even a reduction in everyone's standard of living. The champions of the conservation ethic have been converging into a movement which has been dubbed the Conserver Society. The proponents of this movement of which the Science Council of Canada is front and center argue that these feared consequences need not be. The purpose of this meeting today is to consider the proposals of the Conservative Society and the entire conservation ethic to see just what conservation implies. Hopefully,today's proceedings will help us to understand whether or not the Conserver Society Movement offers a viable alternative and whether or not it offers a new thrust for our society.

TOWARD A CONSERVER SOCIETY

Dr. Josef Kates
Chairman
Science Council of Canada

Introduction:

Good morning, Mr. Chairman, Ladies and Gentlemen.

As your Chairman has said these are difficult times in which we are facing the painful decisions whether to patch up the old ills or whether to give birth to some new future. It reminds me of the story of the lady who was sitting in the doctor's chair and was saying, "Doctor, I don't know what is worse, having a baby or going to the dentist". And he said, "Madame, please make up your mind, I have to know which way to tilt this chair". In the same way we have to know which way to tilt the chair now and whether to give priorities to the old or the new.

As I was preparing my remarks for you last week, I found myself getting somewhat discouraged as I listened to President Carter inform Americans that at least some aspects of the Conserver Society are now a reality for them. The reason I got discouraged is not that I am unhappy to see our neighbours make a valiant attempt to come to grips with their grave energy situation. It is because he kept scooping what I was thinking of saying to you!

I would like to congratulate you on this effort to get your business community thinking along some new lines. Carter's Energy Policy brings home quite dramatically that we are living in a world in transition, and the more brainstorming we do as we hunt for answers to the challenges presented by the need to shift our society away from

dependence on a declining base of non-renewable resources, the better. Society is going to depend on its business community to come up with a lot of bright ideas in the next few years.

In today's talk, I would like to first briefly sketch how the Science Council of Canada came to concentrate a good part of its efforts on the topic of the 'Conserver Society'. I will explain and illustrate to you how we are exploring this subject. Then I will discuss and analyse details of our study - particularly the main policy thrusts and action recommendations which will form the bulk of our report on the Conserver Society which is to come out in the fall. Next I will discuss in some detail what is perhaps the most urgent and important area of application: energy conservation. It is a wide open field and presents business with a very large number of new opportunities. But, as you will see, energy conservation is only one of a number of the thrusts of the transition to a conserver society. So I will also touch on the large and important industrial and technological opportunities that the transition is going to present to people in other fields as well. Finally, I would like to make some general remarks about the type of industrial policies I think we are going to need if we are to be really successful in meeting the challenges ahead.

The Urgency

Twice in the last four years the importance of giving more priority to conservation has been brought home sharply to North Americans. The first time was the OPEC oil boycott in 1973 and the subsequent fourfold rise in world oil prices which sparked one of the most severe economic

depressions and wrought particular hardship on the non-OPEC developing countries.

The second was the harsh winter experienced this year in the United States. It caused severe fuel shortages and the closing down of many industries. Thousands of people had to leave their homes for lack of heat.

These are not isolated events, but important straws in the wind or harbingers of tomorrow. President Carter's comprehensive look at the energy situation is a pretty clear recognition that energy can run out. Much of the material in his recent speeches and those of his secretary of the interior could have been taken directly from our Conserver Society studies, the message from which remained largely ignored by governments and industry until recently.

However, the recognition that we cannot proceed along the trends of the last fifty years much longer is rapidly dawning on our leaders and the adjustments we all will have to make are becoming clearer from day to day.

The Science Council

How did the Science Council of Canada become interested in this topic?

First of all, let me say a few words about the Council. It consists of 25 members from across Canada. They work in the universities and industry and other sectors. We have a mandate to advise the government

and the nation on matters of Science Policy. In other words, we undertake to find out how Canadians can apply science and technology to maximum advantage. For this purpose, our studies have ranged through practically every discipline of science and engineering. We have done studies, for example, in space, nuclear research, water resources, and air transportation.

Studies Leading To The Conserver Society Topic

Prominent among our studies were those concerning resources, including water -- both lakes and oceans -- forests, agriculture, energy, pollution, as well as studies of urban development. It became apparent that many of the problems discussed in the individual studies were due to the overall nature, pace, and directions of development.

In 1973, the Council published a report entitled Natural Resource Policy Issues in Canada. The report urges the country to develop "long-range policies for integrated management of resources and the environment", and it puts forth the idea that "Canadians as individuals, and their governments, institutions and industries, begin the transition from a consumer society preoccupied with resource exploitation to a conserver society engaged in more constructive endeavours". The same section of the report goes on to say that "ideally, Canada could provide the leadership necessary to work toward more equitable distribution of the benefits of natural resources to all mankind". As far as I know,

that was the first time anyone used the term "Conserver Society". It has become well known.

The Conserver Society Committee

The Science Council decided to trace some of the possible implications of a broad conserver policy thrust. A committee with the explicit mandate of studying the implications of a conserver society got underway two years ago. It works under the capable chairmanship of Ursula Franklin, who is a Professor of Metallurgy and Materials Science at the University of Toronto. The other members are Gabriel Filteau, Vice Dean of Science and Engineering at Laval; Ran Ide, who is Chairman of the Ontario Educational Communications authority, and John Pollock President of Electrohome Ltd.

The Study Process

Very early in its work, the Committee recognized that no single agency or department will ever be capable of producing a blueprint that will provide all the answers. Instead, it has concentrated on collecting input and raising awareness by a process of communication and dialogue with an increasingly wider network of people. These objections are carried out in part by publication of a quarterly magazine called Conserver Society Notes. It is essentially a collection of annotated bibliographic references, quotations, and short essays. It has received a warm welcome across the country. Also,

committee and staff members have been involved in an ongoing national discussion of conserver issues by means of many seminars and conferences of the type you have right here today.

The Definition

After much deliberation, the committee managed to set down a definition of a conserver society. I would like to put it before you. The concept of a conserver society arises from a deep concern for the future, and the realization that decisions taken today, in such areas as energy and non-renewable resources, for example, may have an irreversible and possibly destructive impact in the medium to long term. The necessity for a conserver society derives from our perception of the world as finite and of non-renewable resources as limited, as well as from our recognition of increasing global interdependence. A conserver society is, on principle, against waste. Therefore, it is a society which:

-- promotes economy of design of all systems, i.e. "doing more with less;

-- favours re-use or recycling and, wherever possible reduction at source;

-- questions the ever-growing per capita demand for consumer goods, artificially encouraged by modern marketing techniques, and

-- recognizes that a diversity of solutions in many systems, such as energy and transportation, might in effect increase their overall economy, stability and resiliency.

In a conserver society, the pricing mechanism should not just reflect the private cost, but rather it should reflect the total cost to society, including net energy used, ecological impact and social considerations. This will permit the market system to allocate resources in a manner that more closely reflects societal needs, both immediate and long term.

"Toward a Conserver Society"

These notions were expanded in a paper entitled "Toward A Conserver Society: A Statement Of Concern" which was published by the Science Council just over a year ago. It was reprinted in Science Forum and Quebec Science Magazines. It is the result of pulling together the insights, analyses, and information found in the current literature and in our own commissioned studies.

"We live in an advanced industrial society,"it begins. "In the quest for ever increasing productivity, we have been enormously successful ... we have moved slowly from an industrial system which sought to satisfy basic human needs to one which seeks to satisfy ever more exotic needs in ever more costly ways ... but we are coming to realize that there must be limits to this type of activity. There is a widespread sense that the industrialized world has entered a phase characterized by a kind of entropy, where we have run into environmental limits, resource supply bottlenecks, shortage of capital, consumer satiation, and impediments from waste products."

The paper develops a number of guidelines for policies that can help us get back on the rails -- or, I hope, help us to avoid getting off. It served as the integrating framework for the final report, a draft of which the committee put before council at its most recent meeting and which we hope to publish this fall.

One of those guidelines, as the definition states, is that we must aim for economy in design. What this implies is not only the reassertion of the normal values of good design, but also the enlargement of the concept of design to include a greater appreciation of the total system as being finite or closed. The designer must give more attention to the pollution a product may create and to recoverability of any scarce materials used in its construction. Though still guided by the market and its various regulatory constraints, the designer must be encouraged to exercise his or her own judgement and ethic. Only in this way shall we avoid progressing to a more and more bureaucratically regulated society.

If we are to preserve individual freedom of choice as one of our most important values, the consumer must remain the final arbiter. But for consumer choice to be sovereign, rational and able to play its role in the expression of consumer values, the consumer must be presented with adequate and appropriate information. Consumers often do not realize that a lower price paid at point of sale can be followed by higher operating costs over time. An apparently cheaper refrigerator, for instance, may be less well insulated and use more electricity.

We have become used to a high throughput society which depends on obsolescence, a high rate of consumer spending and an almost total disregard for waste, both individually and socially. The realization of limits to low-cost resources, of limits to environmental carrying capacity and of limits to purchasing and consumption capabilities by citizens, means that thrift, saving, avoidance of waste, efficiency and an appreciation of quality will once again become important aspects of our lives.

The remaining policy guidelines discussed in the "Toward" paper include wide recognition of total cost, encouragement of diversity, concern for the future, the questioning or analysis of demand, the implications of the finite nature of the world and of global interdependence. And there are some comments on the importance of individual responsibility and initiative and the influence of governments and large industrial organizations.

These guidelines characterize, I think, what would amount to a conscious, rational response by our society -- including governments, industries, the educational sector, and private citizens -- to the signs of the times. One of the trickiest aspects is the political one. In discussing President Carter's energy strategy, Time magazine for April 4 says, "The United States faces the terrible threat of closed factories and cold, dark homes unless its politicians can master a new kind of challenge; taking painful steps now to grapple with a crisis that will not reach its most dangerous point until long after the President, his aides, and most of the congressmen who will vote on his program have ended their terms of office."

Premier Schreyer, who was somewhat ahead of Carter when he enunciated the same point in a speech to the Consumers' Association of Canada last year, if I may quote from it. "We face the paradox that it may well be that the most responsible course of action we can follow today might be the most unpopular. It may be the more responsible for the next generation, but the next generation does not vote yet. I really believe that this is already, and will prove to be in the next decade or two, one of two most profound dilemmas that can face any democratic society in government."

I strongly believe that measures necessary for the long term welfare of society which may cause a bit of discomfort today, can become much more palatable if instead of waiting for the crises in energy and other resource supplies that are bound to come, we prepare now to learn to live comfortably within our income.

For business, this means casting about for ways in which our enterprises can tap the waves of the future. There are many examples currently in existence of products and enterprises that will characterize tomorrow's sustainable economy, and the potential markets for a number of new -- and some not so new -- conserver technologies are impressive indeed.

All that is required, as the saying goes, is a stretch of the imagination.

Business Opportunities in Energy

a) Energy Conservation

I would like to quote a statement from last Thursday's New York Times article on President Carter's Energy Program. "Only by saving energy can we maintain our standard of living and keep our people working."

The Office of Energy Conservation of the Federal Ministry of Energy, Mines and Resources has been trying to implement a Conservation Program in Canada, as have a number of provincial governments. I have been urging the nation at every opportunity to get serious about conservation before we face real difficulties that are bound to come. There are small signs of success, such as the Federal Government's commitment to reducing its overall energy consumption, the removal of the sales tax on insulation materials, and so on.

Basically Canadians are not moving on energy conservation yet. Let me tell you very quickly why I think we should. Essentially, in the last thirty years, during which the energy has been cheap and plentiful, consumption has increased three-fold. Canadians have become so used to this pattern that it is generally assumed that consumption will continue to grow at an exponential rate. The breakdown of energy sources for Canada in 1975 is:

65 per cent from conventional oil and gas sources

26 per cent from electricity

9 per cent from coal, and other sources.

About one-third of total energy used went to industry, one-third for transportation, and one-third to heat and cool buildings and run the appliances they contain.

According to the assumptions which underly most current Canadian energy planning, this demand will double by 1990. But a quick check list points to the construction, transportation and maintenance difficulties of Labrador or James Bay hydro projects; the technical problems of the Tar Sands development; exploration and extraction problems in the Artic Sea; high cost and public sensitivity concerning environmental dangers and waste disposal with respect to nuclear power.

These factors mean that investment requirements and operating and other costs of proposed future supplies of energy will be much greater than we have been used to in the past. Current estimates of the capital investment needed to produce the energy requirements projected for 1990 range from 170 to 180 billion dollars. This rate of investment relative to Gross National Product would be 50 to 100 per cent higher than that of the last 25 years; this despite the shortage of domestic and foreign capital. Although economists have not really determined what we can afford to spend on energy, my own judgement which I cannot prove is that it is at most half of what has been forecast.

This situation inevitably creates distortion in the capital market and militates against the rapid and effective implementation of other national programs of high priority -- particularly essential investments to increase the productivity of embattled Canadian industry, which

ultimately produces the wealth that determines our standard of living. These distortions are likely to increase inflation, upward pressures on the Canadian dollar, thus further reducing our already weakened ability to compete in the international marketplace.

Furthermore, the cost of that energy will be something between three and nine times as high as today's for the average Canadian family. That would be quite a whack out of the typical family's budget. The question is what is going to give? Is shelter going to give, is food going to give; what else is going to give if we carry on like this?

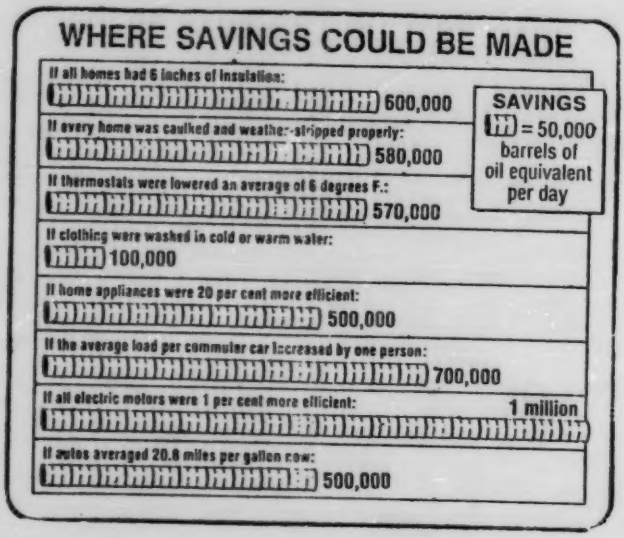
Lower energy consumption combined with a high standard of living is a fact elsewhere in the world. In West Germany, for instance, the country uses less than one half of our own per capita energy consumption. West Germany is one of the wunderkinder of industrialization, as you all know. Even in Canada, only 15 years ago we lived with roughly one-half of current levels -- and times were not so bad.

The question we have to consider now is quite simple: how do we move to conserve energy, and where do the opportunities for business lie?

Did you see the recent issue of Newsweek magazine with "How to Save Energy" on the cover? That article makes the point that conservation is our best investment right now, it is far cheaper than bringing on that elusive new supply and the returns are instant and impressive. I can give you some examples. Between 1973 and 1976 Carleton University in Ottawa spent about 20,000 dollars on simple measures like tuning

air conditioning equipment and installing light switches. They remove surplus ceiling lamps and replaced them with lamps near work surfaces, they metered buildings to permit better energy management. With these and other measures, they have saved -- so -- $600,000.

By now I think pretty well everyone has heard of other similar examples. The Newsweek article included this chart, obviously the quantities of oil saved do not apply to Canada, but the point is that these are the developments that we too are going to see in our energy picture, and in the not too distant future.


WHERE SAVINGS COULD BE MADE
If all homes had 6 inches of insulation:
600,000
If every home was caulked and weather-stripped properly:
580,000
If thermostats were lowered an average of 6 degrees F.:
570,000
If clothing were washed in cold or warm water:
100,000
If home appliances were 20 per cent more efficient:
500,000
If the average load per commuter car increased by one person:
700,000
If all electric motors were 1 per cent more efficient:
1 million
If autos averaged 20.8 miles per gallon now:
500,000
SAVINGS
= 50,000 barrels of oil equivalent per day

Let us consider them for a moment, not as constraints, but as possible business opportunities. Because rather than wait until governments have to impose rationing and other restrictions, business can lead us to the conserver society.

An important aspect of energy conservation is to maximize the efficiency with which we use the energy available to us. It is not simply a question of not letting the heat fly out of badly insulated houses and badly fitting doors and windows, but of wringing the maximum advantage out of every unit of energy.

One very interesting prospect which has not sufficiently proliferated yet and which provides a lot of industrial opportunity are heat pumps. These machines suck heat out of the air or the ground or waste hot water (of which a great deal exists in our industrial society - an example of energy failing technology which is going to become very prominent). They can double both as heating and cooling units, and according to a billboard that Lennox Air Conditioning put up last winter, they can save you up to 40 per cent on a winter's fuel bill. A recent article in Forbes magazine talks about the great success Carrier Corporation is having in selling heat pumps. They have enabled it to recover from the disastrous effects of the energy crisis on air conditioner sales.

Another area where I think there is going to be a good range of opportunities for business as we assimilate the reality that energy is a precious commodity, is systems analysis. Already a number of

consulting firms have been set up whose business is to come into a plant or home and find the energy leaks and tell the owner how to eliminate them. Ontario Hydro's new building in Toronto, Hydro Place, has computers monitoring its energy use in order to maximize the benefit obtained from such sources as the sun shining through the windows and the heat generated by people working in the building. Unfortunately, there are too many instances today of buildings where machines doing the heating counteract the machines that do the cooling and thus cancelling each other out and using up a great deal of energy in the process.

In the area of transportation, one of the biggest users of energy in the country, we are going to see quite a few innovations in coming years. Right now some businesses are carrying their employees to and from work in commuter vans, and I think we are going to see a lot more of such measures. Generally there is a large area for opportunities by increasing the attractiveness of collective efficient transportation modes whether they are charter airplanes, mass transportation or what have you.

Business Opportunities In Energy

Renewable Energy

As a society we must begin to look at energy in a new way. So as to ensure continued energy for a sustained future we must begin to invest in energy sources which do not deplete but which have the capacity to be

renewable. We are going to depend on the conventional sources of gas, oil, coal, hydro and to some extent nuclear for some time yet of course, but we must begin the transition now from a society which draws down its energy capital (in other words non-renewable resources) to an economy which can survive and prosper by living on a continuing flow of energy income arising from renewable energy.

Studies for the Science Council indicate that by the year 2000 renewable energy will contribute between five and ten per cent of Canada's energy requirement. If one includes hydroelectricity, this rises to 20 per cent. By 2025, it will probably have increased to some 30 per cent.

The potential business in these technologies is quite staggering. By 1990 the total market for solar equipment, installation, maintenance, and so forth, could be as high as $11 billion in Canada. (My personal opinion is that this figure will probably look very conservative by 1990.) There is a $6 billion market right now in insulation in new and existing housing. By 1990 the market for equipment to tap the energy we currently waste in our agricultural and urban wastes could amount to some $5 billion. The market for recycling could be as high as $4 billion. Methanol, or liquid fuels from the wood in our forests and that we currently waste, could be a $2 billion industry. Wind energy, an area where Canada currently has a strong technological edge, could be a $400 million industry.

If I had been making this speech to you a year or so ago, I would have gone to a lot of trouble to try to convince you that things like solar heating are not just pipedreams. By now, I am pretty sure that events and President Carter have done the job. In Canada, for instance, besides the solar demonstration you have here in Winnipeg on the roof of your Legislative Building, we have moved from something on the order of 15 or 20 solar homes in 1976 to about 50 today, and the latest estimates are that by this time next year there should be between 250 and 300. It should be noted that in Toronto one of the major developers is now offering a solar package with the house. You can actually commercially buy a house and pay $4000 more to acquire a solar package which I believe is supposed to look after about 70% of the heating needs of the home.

Recycling

I mentioned the recycling industry a moment ago. Time is a bit short for me to go into much detail, but as our studies at the Science Council have shown, it is clear that we are soon going to have to pay very close attention to the materials we use because their prices are going to throw our economy for a loop as we run into shortfalls in supply. Opportunities in reprocessing, reclamation and reusing materials should be tremendous.

Conclusion

To truly tap the opportunities these developments present us, however, I think what we need in Canada is a heightened commitment and

to relate these opportunities to our industrial strategy. The Science Council's Report on the Implications of a Conserver Society is going to recommend the creation of a national focus for renewable energy, which might be something like a crown corporation such as Atomic Energy of Canada Limited or Petrocanada, or more of a centralized information clearinghouse and granting agency. I urge you to urge legislators at all levels in this country to give serious consideration to redesigned programs of industrial incentive and tax structures which will encourage Canadians to get moving toward an economy which will not depend on depletable resources.

Our dependence on the know how of foreign-based multinational corporations is sometimes painfully evident. I think that government planning must take this into account as well. We need to be very careful to preserve what the Science Council is calling Canada's "Technological Sovereignty". One of the weaknesses of the Canadian economy has been an over-dependence on foreign industry which has resulted in truncated industries, fragmentation and great exposure to the vagaries of economic climate. Here in western Canada we are concerned with the concentration of industry in eastern Canada and an over dependence on the resource industries. We believe that the building of a strong Canadian industrial base should be done with an eye on the future rather than the past; with an eye on the baby instead of on the old teeth.

Industry in society will have to undergo major changes during the next generation and the products, processes and services needed for a conserver society are not yet dominated by strongly entrenched

multi-national companies. Moreover many of these products and processes involve a medium rather than high technology and have opportunities for small and medium sized companies and for decentralized activities.

I have deliberately included a number of American illustrations and examples in this talk because one of my main objectives in speaking to you today is to alert you to the very strong possibility that while we complacently consume our last few decades of non-renewables, if present trends continue, foreign-based multinationals will be sending around their salesmen to sell us over-engineered versions of technology we could have brought on stream ourselves.

Winnipeg, you know, could become the capital of renewable energy in Canada. Your excellent Biomass Energy Institute and last year's highly successful joint U.S. - Canadian Solar Energy Society Conference, not to mention the solar project on the legislature, may mark you as a pace-setting group. I hope so.

Thank You.

Discussion

Leonard Remis - Chairman

Thank you Dr. Kates. I think you have outlined the parameters of the problem and indicated some of the high points in business opportunities. Hopefully the rest of the day will be able to build on what you have been telling us. Now I am sure there must be some questions from the audience and I would ask you to step forward if you have any. However, to start things off I have one of my own that I would like to ask. It veers a little away from what Dr. Kates has been talking about but I think it is central to the whole idea of the Conserver Society. I have read Amory Lovins' paper in Foreign Affairs October, 1976 and it is sort of a founding or bench mark in the development of the Conserver Society. After he talks about hard paths, soft paths and many other things that you probably are familiar with, I came to a paragraph which says,

> "Perhaps the most profound difference between the soft path and hard path is their domestic social political impact. Both paths like any fifty year energy path entail significant social change but the kinds of social change needed for a hard path are apt to be much less pleasant, less plausible, less compatible with social diversity and personal freedom of choice and less consistent with traditional values than the social changes that could make a soft path work".

I think that we in thinking about what the Conserver Society is saying, it is important to note that what they are suggesting will have important social political implications for all of us. Would you like to comment on that?

Josef Kates

Yes, we have had Amory Lovins, several times at Council and, in fact, in one of the Conserver Notes we printed some of the forecasts he made for some of the possible alternative energy futures for Canada. I think what Amory Lovins primarily is referring to when he says we are talking of a different society for each of the hard or soft path is the question of different implications. For instance, let us think of the nuclear society which is a renewable society and particularly let us think of the problems that would be raised by what we call a plutonium society. Such a society would probably require an amount of policing and controlling that civilization so far in its history had not demonstrated an ability to implement and maintain. I think that is really what he is talking about. To some extent he also refers to other kinds of capital in terms of non-renewable developments which also have some impact. If we had an entirely coal society we know that we would have a tremendous problem of mercury pollution and we would have to find ways of converting coal that avoids that amount of mercury pollution. However, I believe what he has primarily in his mind are the problems that we would be faced with if we went all out nuclear.

In my opinion that is the real problem confronting us. It is not just of non-renewable versus renewable but in the non-renewable area itself the question of inefficient nuclear society has some very dangerous implications even if at the present nuclear development is not so dangerous. Some of you may have read the Atlantic magazine last month which has an excellent article on nuclear proliferation. When we get into reprocessing and moving large amounts of plutonium all over the map the kind of control problems that we envisage are very fearsome and would require a degree of

control that I think most people have not fully realized.

Ben Hogg - Vice-President Academic
University of Winnipeg

Dr. Kates referred to heat pumps and as we know the local climate in Winnipeg is a fairly brisk one in the winter. I think the efficiency of these things generally in this latitude would be rather low if not at just the break-even point of putting in as much energy as you take out. However, Winnipeg may just be the exception. I believe we have beneath us a reservoir of an almost unlimited supply of water. I am not sure what the water level is down there at the moment but I gather that in normal times it is at an appropriate level and at about the right temperature for interfacing with a heat pump. I believe that somewhere in this room there may even be people with technical knowledge about the heating performance of heat pumps in the Wandlyn Birchwood Inn out on Portage Avenue. I think it might be of interest to this group to know about that experience because if we do have this reservoir of 45 deg.F. water beneath us, the heat pump would certainly be an ideal option for this particular locale at this latitude. It may not be very generally used but certainly I gather we can use it here. I know that the cooling process has been used for a number of years at the University of Manitoba by tapping this reservoir to cool the cyclotron at more or less no cost.

I would like to inquire just generally whether my basic assumptions are right; that trying to extract heat from let's say -40 deg.C. (or F.) would not be a practical sort of thing to do.

Josef Kates

Well, first of all let me say that I am not an expert in that area so I can just tell you what my understanding is and if it is wrong I stand corrected. I think you are quite right in what you have just said. However, there are two considerations that make heat pumps look like an attractive alternative. First of all, heat pumps now being built are far more efficient than apparently has been the case until fairly recently. I have talked to the people in the utilities and they have told me that the efficiency of the heat pumps that have been built in the last two or three years is far greater than, let us say, your ordinary air conditioner or something like that which is a heat pump.

The second point is that the heat pump ought to be used in conjunction with what you would call a systems study. In other words, like you just mentioned in your example, we ought to look for places where there are heat or cold sinks that we can make use of - possible to a heat bank in the soil itself - and we should not necessarily, in a climate like ours, relate just to the outside air temperature. What is very evident when these studies are made is that we are wasting an awful lot. Most of the heat goes to heat lakes. This is true for many utilities and many factories. Thus, we must look for opportunities such as I have mentioned in the paper. For instance we could use waste heat water in conjunction with a heat pump to recover some of the heat. On that point I had better stop or I will give my ignorance away.

Leon Katz - Director
Science Policy Secretariat
Government of Saskatchewan

My name is Katz. It sounds very much like a speaker's name but it is spelt slightly different. I am with the Government of Saskatchewan. Let me say, to put the record straight that basically I believe in the Conserver Society. Also I think I am in good company. I noticed that about five weeks ago the Conference Board issued a bulletin on energy where they make a most interesting statement. They said that for most increasing material societies, production continues to be the basis for increased human welfare. I believe, of course that we must all become conservers on a personal basis. We must make do with a little bit less for a little bit longer. We will need to put patches on the elbows of our jackets and perhaps not trade in our cars as often as we have been. Who knows,maybe we will even have to share our hot bath water with our neighbour.

I would like to ask about some deeper implications. It is so easy to talk about the Conserver Society but all the recommendations have other implications for us. For example, what will happen to our employment picture when we all start to use our cars,three, four or five years longer than we have in the past. Who will convince many manufacturers, for example a manufacturer of toasters that instead of spot welding the units together which makes it cheaper to produce, that he should put in screws so the toaster can be taken apart and serviced and made to last longer. Also do the recommendations of the Conserver Society mean

stronger government control? Although I think many of us are changing our personal habits there are still quite a number of people who are not sufficiently convinced to do so. To summarize my question, can we implement a real conserver society within the present framework of our economic and social structure?

Josef Kates

This was a fine set of questions from Leon Katz who incidentally was a charter member of the Science Council of Canada. We at the Science Council of Canada, have just gone through the draft of our official report and these questions are very close to the questions which I asked but which we could not answer. Therefore, at the moment, I can only speculate. I understand that another speaker who represents the government group and who will speak later on in the day has made some economic studies on the impact of the Society. I will be very interested in what he has to say.

What does bother me is that we have not yet done sufficient work to answer those kinds of questions. In other words what is being said by the Conserver advocates basically, is this: "there are a lot of working opportunities so let us get after them". What in my opinion they have not proven is that those working opportunities will fully replace or exceed the working opportunities which we will lose. A second thing that some of them have pointed out is that, in spite of the fact that we are in an age of welfare payments and unemployment insurance, unemployment is not very important. I fully disagree with that assertion. I think one

of the biggest problems with the Conserver Society proposals is that the unemployed are losing their self esteem. If, in fact, we are working towards a world in which the total manpower requirements at today's standards of employment - in other words a 35 or 40 hours week - are much greater than the available valued employment opportunities, then we should look towards a much more flexible employment pattern. In other words, I see no reason that we should be in this step function society where up to the age of 20 or 22 a person is outside the employment pool and then suddenly he is in the pool and must stay in it until he is 65 and then at that point he is forced out and forgotten. I think we could spread the work around more flexibly. In addition I think it should be pointed out that there are many, many employment activities which are not material or energy intensive. For instance the electronics industry is, to a large degree, not energy or materials intensive and in many ways can substitute for much more materials and energy intensive activities, process and products. We should encourage such substitution. Also, there are many social services where I do not think we have yet reached the limit and they all add to GNP. We should concentrate our efforts on them. In other words what I am really saying is (a) we should give great incentive to those activities which are not material and energy intensive, (b) we should develop the new processes, prospects and services of the Conserver Society and (c) if all that is not enough, we should really look at our working pattern, not with the idea that unemployment does not matter, but with the idea that what is considered acceptable full-time employment can be changed. I have the feeling that many of the people among the older groups, let us

say my age group, would be quite happy to reduce their work week. Perhaps they could work say three hours less a week or have longer holidays. In that way, we could spread the work around. In light of these comments, I would like to mention a proposal that I have made to the Science Council (I do not know whether or not they will adopt it in their report). It would be very nice if as an index of economic activity the measurement of the percentage of unemployed could be replaced by a measure of total hours worked in the economy. Then when the economy enters into a recession the index will go down and when the economy is improving the average will go up. This type of measure would tend to de-emphasize the importance of having a regular 40 hour a week job for everyone.

Finally, we do have to make much better analysis now in any attempt to smooth out the transition from the presently produced goods and the presently used processes, to the ones required in a conserver society. My feeling is that the way to work is not to shut down one process and institute another but to bring in the conserver processes gradually. We have a very good example of this. The first chairman of the Conserver Society Committee was John Pollock, the President of Electrohome (I have since asked him to be chairman of our Industrial Committee). Electrohome is a company that is having great difficulty with the current industrial malaise because they make color television sets and other kinds of consumer goods that, of course, are being imported from countries like Japan at very competitive prices. In any event, John Pollock is already re-orientating his own company towards the conserver thing. He is already going after such things as solar heating components. In other words he is not just sitting back

and watching his business going down the drain. Now that he has been alerted to some of the opportunities due to the fact that he has been a member of the Conserver Society Committee he is busily attempting to introduce some of those opportunities in his own company. What I am really saying is that in situations where, lets say, a company is faced with a reduction in total output due to the introduction of longer life components, it would be best if that firm started going after other conserver products and services that could most easily - that is with only a minimum of restructuring - replace the lost production. In that way individuals make a smooth transition because I am not sure that economists in a very short time can give us all the answers to the questions that Dr. Katz has just posed. As I say we have got to study those questions.

Tom Pepper - Executive Director
Saskatchewan Research Council

I would like to ask a rather specific question which I think follows quite naturally from Dr. Katz's basic question. First I would like to quote from Dr. Kates speech. On page 22 he said "I urge you to urge legislatures at all levels in this country to give serious consideration to redesigned programs of industrial incentives and tax structures which will encourage Canadians to get moving towards an economy which will not depend on depletable resources". I just would like to ask a rather simple question. I realize Dr. Kates that you may not wish to speak personally about your thoughts on tax restructuring or on the Science Council but - if you can refer to some anonymous conversation that you may have heard -

have you any specific thoughts about tax restructuring or industrial incentives that might give me some rather concrete ideas as to how we might be able to proceed in following recommendations.

Josef Kates

I do not mind being quoted on these matters. In fact I have been quoted in the past. For instance the May 14, 1976 issue of Energy Analects has the headline "Kates urges tax incentives to stimulate national conservation drive"(I have copies of it here for anyone who wants one).

My feeling is that the tax system is by far the most important system to accomplish anything that you want to accomplish in a decentralized incentive way (which is in contrast to a directed government program). There are all sorts of tax incentives. You can give tax incentives for a business to develop new products and in fact some such tax incentives have shown up in the most recent federal budget. You can also give tax incentives to the individual for the use of such products. For example, the government so far has taken certain taxes off insulation material. You could go a step further and make insulation installation or any kind of conservation installation tax deductable. In other words these deductions could be used on your income tax forms the same way that you use a charitable donation or something like that. Finally, and this is really going back to Dr. Katz's question, I have a feeling that if we are moving into what we call a slow growth era where we are really worried about employment and if we are shipping jobs abroad, there is a real good question of whether or not we should have differential tax system; a system that taxes

differently that part of a company's output that is due to capital than that part of the output that is due to labor. In other words, my feeling is that labour in our system is double taxed. A company, in fact, pays tax on the part of the profit that is produced by labour and then when the labour goes home they pay taxes once more. So you have here a situation of double taxation. In the last analysis of keeping employment up in this country becomes important I wonder whether we should not consider tax systems in which the labour component of profit is either being taxed at a lower rate or not at all. In other words, if a company was entirely labour intensive you would not tax it at all. For instance, if you had a service company that had no other expenses than labour,you do not have such a thing,but service companies have generally maybe up to 20% of their costs on materials and space and so on and 80% of their costs on labour (some other types of companies have 80% of their costs in depreciation and 20% of their cost in labour), it could be tax free. I do not want to go into detail but there are innumerable schemes. They all have one thing in common however. They put the onus on individual group initiative rather than on these groups being a part of a centralized program. The reason is that in the tax systems the person wanting to take advantage of incentives will take the initiative. In other words, he makes the decisions, he files his tax forms; tax officers can get after him and challenge him but he takes the initiative. In all other government programs such initiative is dulled. The individual has got to go to some bureaucrat and get permission to do this or that and he enters into a red tape machine that is terribly

discouraging before he even gets started. That is why I am a really strong advocate for the use of the tax system for incentives towards a conserver society.

Bob Hart - Vice-President
Atomic Energy of Canada Ltd.

I know Leonard has been trying to draw me into this discussion so I guess I will get into it.

I, like Leon Katz, am very much concerned about employment in the Conserver Society. In the talk that I am going to present next I will try to give some indication of the bill for some of these things that are being suggested. I think, however, there is one thing that I should challenge now and that is the assertion of the need for a massive security system for the use of plutonium. I think that the hazards of plutonium are certainly rather exaggerated in society. We do have about six tons of it floating around in our atmosphere right now from weapons testing. The reprocessing plants have, in fact, been operating in other countries for some twenty-five years now and we do have good measurements of the releases of radioactivity from those plants. We have, in fact, methods of following the pollutants through the environment and measuring, in at least a semi-quantitative way, the effects of them. So I think that this whole issue is exaggerated. Perhaps the main thing that I should mention is that we see no need to ship separated plutonium around the country even if we in Canada go to the thorium fuel cycle which involves the use of plutonium. We have submitted to the government a research program to try both to develop the technologies and to identify the

hazards of this energy source so that if it is required some twenty or thirty years down the line it will be available. Part and parcel to that scheme is the fact that the separated plutonium never come out of the plant. Gordon McNabb, in a talk down in Halifax on the 4th and 5th of April made a comment that I think is pertinent to this discussion. He stated that it would be fairly easy to get a saving of about twenty-five per cent in the rate of increase in energy growth but to get a fifty per cent saving in the rate of energy growth will involve some very massive government regulation no matter what energy source is developed. I am not sure which of the societies will require the greater government regulation.

Josef Kates

I have been asked to be brief. My answer was given in the context of Amory Lovin's point of view. I think that what he had in mind was the light water technology,breeder reactors in Europe particularly where there has been a proposal for a number of reprocessing plants and for large shipments of plutonium from one to the other with the resulting risk of exposure. As a great believer in Murphy's law -- I can recall that only a few months ago while I was at a seminar being told all about the safety of underwater oil exploration. Yet this very week with the fiasco in the North Sea, we have a very good example of just how safe it is. I just wonder whether we should expose society to the risks involved with the further development of nuclear energy. I do quite agree however, that the Canadian technology, the heavy water technology in particular, if we went with it towards a thorium

cycle is a considerably safer one. Nonetheless my feeling is that there is every indication that we should go for the renewable technologies and if we give them the same effort we give the nuclear technology I am very hopeful that so much nuclear technology would not be necessary.

3.

SOURCES, AVAILABILITY AND COSTS OF FUTURE ENERGY

Mr. Robert G. Hart
Vice President
Atomic Energy of Canada Ltd.

First of all let me say that I am very pleased to be with you today and to have been asked to speak on the very important but also very complex subject of sources, availability and costs of future energy. Although our responsibility in AECL has been the development and application of nuclear energy we have felt it essential that we keep up-to-date on other energy alternatives so that we could put nuclear energy in its proper perspective. It is important that we advise where nuclear energy can best meet our future energy needs; it is also just as important that we advise where nuclear energy cannot meet our future energy needs. To do this intelligently we have had to assess as pragmatically as we could other energy alternatives. It is the results of these studies that I want to share with you today.

I am going to divide this talk into four parts. In the first part I want to talk about points that emerge very clearly through the details of a quantitative look at energy supply. I will call these the truisms of energy supply. In the second part I want to talk about energy resources and indicate which energy resources are likely to have an ephemeral existence and which are likely to be able to meet our needs for a long time to come. In the third part I want to talk about energy utilization because I have found that it is only through a study of the end use that one can get

a clear picture of energy alternatives for the future. In the fourth part I want to talk about costs. Many alternatives are technically feasible; the big question is are they economically feasible?

The Truisms of Energy Supply

First let me talk about the truisms of energy supply. As I mentioned, these are points that emerge very clearly through the maze of details associated with any quantitative look at energy alternatives. I have consolidated them into six points and I will speak briefly on each of them in turn.

(1) The Energy Crisis Is Real

About four years ago in a speech on a university campus I said that we did not have an energy resource crisis, we had an energy conversion crisis. One of my colleagues likes to refer to it as an energy prices crisis. No matter what name you choose there is a crisis. The crisis results from an imminent decline in the availability of domestic oil and natural gas which supply about three-quarters of our total energy needs and a steady increase in the price of foreign imports. In the longer term we face an inevitable depletion of the world's resources of oil and gas. We can substitute for oil and gas in many of its current applications and we can recover oil from the tar sands and bring in gas from the Arctic but these alternatives will take time to implement and some of them will be costly. Clearly we are heading for a period when we will be increasingly dependent on foreign oil with its increasingly deleterious effect on our balance of payments. Just as clearly we need a plan for moving out of this

situation as quickly and economically as possible.

(2) No One Source Of Energy Is Going To Solve The Problem By Itself

It is disappointing to me that so many experts or so-called experts seem prepared to do a very superficial and qualitative review of the energy problem and then try to convince the decision makers that their preferred technology will do it all. For example, for a while it was popular to claim that we did not need coal, nuclear could do it all; then it became popular to claim that we did not need nuclear, coal could do it all. Now the popular theme is that we do not need either coal or nuclear; solar and wind can do it all. Technically some of these conclusions may in fact be correct. However, for the next few hundred years, at least, they just do not make good economic sense. When you start taking any sort of a reasonable look at the economics of the alternatives you quickly arrive at the conclusion that the most economical and the most practical solution to the problem involves a mix of alternatives.

(3) No Source Of Energy Is Completely Benign Or Risk Free

One only has to do a very cursory safety analysis to explode the myth that any of the energy alternatives are completely benign or risk free. Methods have been developed for quantitatively doing both risk assessments and environmental impact analyses but they are not as yet widely used. As scientists and engineers we should try to insist on a quantitative evaluation of the impact and the risks of all the energy

alternatives and evaluate them on a comparable basis. We simply do not do this now.

(4) Energy Sources Other Than Those in Use Today Can Supply No More Than About 10 Percent Of Our Energy Needs In The Year 2000

It is a fact of life that new technologies require long induction periods before they start to make a significant impact. Thus even if energy technologies such as coal gasification, geothermal, wind, tidal, biomass, breeder reactors, solar energy or fusion, were demonstrated today to be economically attractive they could not be introduced at a rate sufficient to make a large contribution to our energy needs by the year 2000. Arnold Cohen in a recent position paper on solar space heating estimates that, with an active effort, the solar heating industry in the United States could only be expanded at a rate sufficient to provide solar heating to 100,000 buildings a year in 1990 and 600,000 to 2,000,000 buildings a year by 2000. At this rate only 1 percent to 3 percent of the total United States energy needs could be met by solar home heating by the year 2000. Thus whether we like it or not the only options we have for significant substitution before the year 2000 are those that are commercially proven today.

(5) Conservation Can Make An Impact And It Should Be Exercised Wherever Feasible

As Dr. Kates has stated we waste a lot of energy. This is a throwback to the period when energy, particularly oil and gas, were cheap. Clearly we must eliminate this waste. However, conservation will not eliminate the need for more energy. Estimates made in both Canada and the United States indicate that conservation can, at best, only reduce the

rate of energy growth by about 25 percent unless we wish to drastically change the way we live. No quantitative study that I am aware of indicates that we need to make a drastic change in the way we live. We do have energy resources that can maintain our current life style for many centuries to come; the problem will be one of substitution and conversion.

(6) People Are Going To Have To Pay A Higher Fraction Of Their Incomes For Energy In The Future Than They Have Had To Pay In The Past

None of the future energy technologies being considered today are as simple as drilling a hole in the ground and pumping out oil. Consequently it is axiomatic that, even in constant dollars, energy costs are going to increase. I emphasize constant dollars because I do not think that in real terms they are going to increase as much as people think. Nevertheless all viable alternatives involve large capital outlays and the cost of money will contribute more heavily to the cost of energy than it has in the past. These projects will undoubtedly provide extensive employment opportunities so it is extremely important that, whatever the future source of energy, we provide both the hardware and the technology ourselves.

Energy Resources

Now let me turn to the question of energy resources. For this discussion I will primarily use the unit $Q = 10^{18}$ Btu. To put the discussion in perspective the world now uses about 0.1 Q of energy per year. However, if all of the world's current population of four billion used

the same amount of energy as we do in Canada and the United States, the world would use about 1.2 Q per year. Even though birth control technology is now rather well developed few estimators would claim that the world's population will stabilize at less than ten billion and it is generally accepted that such a population could not live in peace and harmony without a significant leveling of the world's living standard. If we assume that it is leveled up to North American standards, which I think most of us would prefer, we are facing a world energy demand of at least 3 Q per year in the not too distant future. I say at least 3 Q per year because if current energy demanding trends such as increased pollution control, increased recycling of materials and increased need to use low-grade resources continue, the demand will increase. In fact the predictions I have seen seem to average about 6 Q and some are as high as 10 Q.

Although it is not generally recognized, it is possible to make a reasonable inventory of the world's energy potential. For example, one can use the reasonable hypothesis that all of the oxygen in the earth's atmosphere was generated by photosynthesis and thus arrive at a reasonable estimate of the total amount of energy laid down in fossil deposits. Also one can use both cosmic abundance numbers or measurements of the thermal flux through the earth's crust to determine the average crystal abundance of uranium and thorium. I have used numbers of this type to develop the overview of the world energy potential shown in Table 1.

Table 1

Overview Of Total World Energy Potential

Source	Total Energy Available
Fossil	10,000 Q
Nuclear Fission[1]	10^9 Q
Nuclear Fusion[2]	10^9 Q
Solar[3]	5,230 Q per year
Wind	9 Q per year
Hydro	?
Tidal	?
Geothermal	?
Wood	?

1 Based on total U and Th within a mile of the earth's surface.
2 Based on total Li within a mile of the earth's surface.
3 Based on total solar energy intercepted by the plant.

You can see that on this simple basis we have the potential of meeting the requirements of our 3 Q or 6 Q or 10 Q society using virtually any of these sources of energy for some time to come. However, now we come to the question of practicality. In dealing with this question we must consider questions like - what fraction of the fossil and nuclear fuels exist in concentrations that can be recovered economically, how much of the earth's surface can be covered with solar receptors, how much of the wind energy exists at velocities which make recovery practical and how much of the water and tidal energy exists in areas where the topography permits exploitation. Some of these questions have, of course,

been explored in much greater detail than others. For example, it is now generally considered that coal resources should only be put in the practical category when they exist in seams over 14 inches in thickness at depth above 4000 feet. Also current economic analyses indicate that uranium and thorium resources should only be put in the practical category when they exist in concentrations above 100 ppm within 1.5 miles of the surface. Clearly these definitions will change as the costs of energy alternatives change but, as we will see later, they are not likely to change, at least in constant dollars, in the near to medium future. Definitions of this type have been used to develop the energy picture given in Table 2. This is normally defined as the energy resource picture.

You can now see that if our estimate of resources is correct, coal and lignite could fuel our current 0.1 Q society for 1900 years but could only fuel our 3 Q society for 63 years. Oil and natural gas could fuel our 0.1 Q society for 240 years but could only fuel our 3 Q society for 8 years. Hydro could make a significant contribution to a 0.1 Q society but in the world's underdeveloped countries we must assess its potential against the 3 Q society; here it will make an important contribution but will fall far short of the total need. Tidal and geothermal can only make important contributions in localized areas. Of the options listed then we must look to fission, fusion, solar or possibly wind to provide energy to the 3 Q, or 6 Q or 10 Q society of the future.

Table 2

Practical World Energy Resource Picture

Source	Energy Content	
Coal and Lignite[1]	190	Q
Petroleum[1]	11	Q
Natural Gas[1]	10	Q
Tar Sands[1]	1.7	Q
Shale Oil[1]	1.1	Q
Nuclear Fission[2]	10^6-10^8	Q
Nuclear Fusion[3]	10^6-10^8	Q
Solar[4]	15	Q per year
Wind	0.03-0.6	Q per year
Hydro	0.09	Q per year
Tidal	0.002	Q per year
Geothermal (Natural)[5]	0.002	Q per year
Wood	?	

1 Based on distribution in known geologic formations and assumption that similar distributions will exist in similar geologic formations in the earth's crust.

2 Based on analysis method developed by Johan Brink and tested on other metals. Uses concentration distribution in known mining areas and average concentration in earth's crust. Assumes use of all the U and Th in breeders. Lower number includes resources in large deposits only; higher number includes small deposits.

3 Assumes that the amount of energy is limited by availability of Li and that the same fraction is recoverable as for fission fuel.

4 Assumes use of 1 percent of land area is practical.

5 Excludes the as yet unknown potential from pumping water into areas where hot dry rocks exist close to the surface.

As we progress from the 0.1 Q society to the 3 Q society coal will play a significant role but the days of our heavy dependence on oil and gas are limited. They will of course play a vital role and have a major economic impact while they are still here.

I have not yet introduced the concept of proven resources and perhaps I should do so now. For simplicity here I have lumped a number of categories such as proven, inferred, assured, reasonably assured, prognosticated and so on into this category so my numbers are not likely to be consistent with other numbers you may see listed as proven. However, for the sake of this paper this does not matter because the conclusions are the same no matter how you lump the numbers. Consequently I am going to define proven as those resources which are reasonably well defined by drilling, sampling, and other similar methods. In Table 3, I have repeated some of the resource numbers that I listed in Table 2 and have added a column headed reasonably proven.

Table 3

Reasonably Proven World Energy Resources

Resource	Energy Content	Reasonably Proven
Coal and Lignite	190 Q	31 Q
Oil	11 Q	2.4 Q
Natural Gas	10 Q	
Nuclear Fission	10^6-10^8 Q	320 Q[1]
Nuclear Fusion	10^6-10^8 Q	?

1 Excludes communist countries as their reserves have not been reported.

It will be noted that only a very small fraction of the nuclear fuel resources are listed in the reasonably proven column. This is because up until about a year ago the price of uranium was not high enough to encourage exploration. There is still no economic incentive to look for thorium or lithium. However, it should be repeated that the total resource is well defined by thermal flux and cosmic abundance methods and it is only the distribution that is in doubt. Even at that the energy available from the reasonably proven resource, assuming that it is all burned in thorium and uranium breeder cycles, is about 320 Q.

So far we have only looked at the world resource picture. Energy is of course an international commodity and certainly over the long term it is the world picture that is likely to dominate. However, since the national resource picture is also important in any consideration of costs and a national energy strategy, I will now look at the national picture in the same way I considered the world picture. I see no real point in dealing with the total potential energy resource picture on the national scale so I will move directly to the practical resource picture. Table 4 gives this picture for Canada. To put it in context, Canada now uses about 0.006 Q of energy per year.

Table 4

Practical Canadian Energy Resource Picture

Source	Energy Content
Coal and Lignite	2.4 Q
Western Canada Oil	0.022-0.032 Q
Arctic and NWT Oil	0.14 -0.30 Q
East Coast Oil	0.20 -0.24 Q
Oil Sands	1.4 Q
Alberta Heavy Oil	0.15 Q
Western Canada Gas	0.057-0.131 Q

Table 4 (cont'd)

Practical Canadian Energy Resource Picture

Source	Energy Content
Arctic and NWT Gas	0.45 - 0.63 Q
East Coast Gas	0.33 - 0.43 Q
Nuclear Fission[1]	$6x10^4$ - $6x10^6$ Q
Nuclear Fusion[1]	$6x10^4$ - $6x10^6$ Q
Solar[2]	0.5 Q per year
Wind[1]	0.002 - 0.04 Q per year
Hydro	0.005 Q per year
Tidal[3]	0.001 Q per year
Geothermal	?
Wood[4]	~ 0.01 Q per year

1 Assumes that since Canada has 6.7 percent of the world's land mass it also has 6.7 percent of the world's resources as listed in Table 2.

2 Based on 1 percent of land mass assuming solar isolation at the 49th parallel.

3 Approximately half of the world's tidal power potential exists in the Bay of Fundy area.

4 Rough estimate made in a later section.

You can see that the general picture for Canada tends to parallel that for the world. Coal and lignite could fuel Canada's 0.006 Q society for about 400 years but Western Canada oil and gas could only meet that requirement for from 13 to 27 years. Frontier oil and gas resources, if confirmed, could meet our requirements for 190 to 270 years and our tar sands and heavy oil deposits could add another 260. Again it boils down to a question of economics. Hydro power and tidal power can both play a greater role in Canada than they do on the world scene but the cost of

further development in these areas in relation to other alternatives is open to question. My very rough estimate indicates that wood might have a significant role to play, if the economics are right, and work should be done to assess this possibility. In the long term Canadians, like the rest of the world, will likely have to look to nuclear fission, nuclear fusion, solar or wind to meet most of their energy needs, with solar energy being somewhat more difficult here than in most other countries because of the lower solar insulation at our latitudes.

Again I should probably comment on the Canadian scene in terms of proven resources in relation to the estimated resources. That picture is given in Table 5.

Table 5

Reasonably Proven Canadian Energy Resources

Resource	Energy Content	Reasonably Proven
Coal and Lignite	2.4 Q	0.2 Q
Total Conventional Oil	0.4-0.6 Q	0.047 Q
Oil Sands	1.4 Q	
Alberta Heavy Oil	0.15 Q	
Total Conventional Gas	0.8-1.2 Q	0.069 Q
Nuclear Fission	$6x10^4$-$6x10^6$ Q	66 Q
Nuclear Fusion	$6x10^4$-$6x10^6$ Q	66 Q

In this table the nuclear fission energy value in the reasonably proven column assumes the use of all of the resource in a breeder fuel cycle. If used in this way it could fuel the 0.006 Q requirement for 11,000 years. If used in a conventional natural uranium fuel cycle it

could fuel the 0.006 Q requirement for 55 years. However, again it must be remembered that the total quantity of nuclear fuel in the earth's crust is accurately known; only its distribution needs to be determined by exploration.

In summarizing the resource picture then we can say that both on the world scene and the Canadian scene oil and gas are in short supply and the days of cheap energy from oil and gas are drawing quickly to a close. Coal is in more abundant supply and will assume increasing importance over the next few hundred years. However, for the very long term the world is going to have to depend on nuclear fission, nuclear fusion, solar energy and possibly wind or in some areas like in Canada maybe wood to supply the bulk of its energy needs. In Canada conventional oil and gas resources are likely to deplete more quickly than they will on a world average basis and we will have to depend on frontier oil and gas and/or oil from the tar sands if we want to meet much of our future requirement domestically.

Energy Utilization

Now I would like to turn to the topic of energy utilization. In this part of my talk I want to review the distribution of energy use in Canada today. As I indicated earlier it is only through a consideration of end use that we can get a clear picture of the real alternatives for the future.

The distribution of energy use in Canada today is approximately as shown in Table 6.

Table 6

Distribution Of Energy Use In Canada Today

Electricity	15%
Space Heating	25%
Industrial (Other than electric)	30%
Transportation	24%
Farm Equipment	4%
Other	2%

I do not anticipate that this mix will change very much in the future except as a result of the substitutions I will deal with later.

Alternatives For The Future

Now let me discuss the economics of the alternatives for meeting each of those needs in the future to see if we cannot arrive at a logical direction to follow.

(1) Electricity (15%)

First let me discuss the electrical need. This is the only sector of our energy requirement that is not now dependent on oil or gas. The bulk of our electricity is currently produced by hydro power with coal and nuclear coming increasingly into the picture as economically developable hydro sites become scarce. Future electricity supply in the country will likely depend primarily on coal or nuclear. The choice between them will likely be dictated primarily by economics and the economics will primarily be dictated by proximity to coal deposits. In Ontario through 1975 the Pickering A nuclear station produced energy at 7.03 mills/kWh while the Lambton Coal-fired station produced energy at 13.26 mills/kWh. Both

stations are designed to produce 2000 MWh and both were completed at approximately the same time. The effects of inflation and higher interest rates on nuclear power costs can be seen by comparing the Pickering A numbers with that for Bruce A which is going into service now and is expected to produce energy at 11 mills/kWh, and Pickering B which will go into service over the period 1981 to 1983 and is expected to produce energy at a cost of 18.5 mills/kWh. Nevertheless Ontario Hydro predicted in its submission to the Porter Commission this year that coal-fired generation will remain about 1.4 times as costly as nuclear generation on its system for the predictable future. By contrast, recent cost estimates for coal-fired stations in Alberta indicate that those stations, if built over the same period as Pickering B, would produce energy at a cost of about 19 mills/kWh, approximately the same as Pickering B. The difference in the costs of coal-fired generation in the two locations is almost entirely due to the cost of transporting coal. As I mentioned earlier, economically developable hydro sites are becoming scarce so they cannot be expected to meet a major portion of the incremental demand for electricity. However, to put hydro power into perspective it is generally accepted that hydro power will roughly break even with nuclear power if the electricity from the hydro plant is transmitted 500 to 600 miles further than that from the nuclear plant.

No other technology is likely to make a major impact on electrical supply for the foreseeable future.

Recent estimates made at our laboratory using the most reliable information we could obtain indicated that the costs of a solar thermo-electric generating station would have to come down by at least a factor of five before it could produce energy at a cost competitive with nuclear or coal. A plant near Toronto would require a land area of at least 50 square miles for each 1000 MW of electricity produced and would require an as yet non-existent energy storage system to make it practical. At a recent Energy Conversion Engineering Conference in Nevada, September, 1976, Solomon Zwerdling, in an address summarizing the state of the art on solar thermal electrics, stated that the cost reduction required was at least a factor of four and noted the same limitation. Solar photo-voltaic energy is even more costly and recent estimates indicate that cost reductions of 50 to 100 percent are required to make this technology competitive.

Wind energy is plentiful but our studies indicate that it is not likely to be practical for large-scale electrical generation. At an average wind speed of 12 miles per hour, and there are few places in Canada that have average wind speeds that high, one would require 40,000 windmills, 100 feet in diameter, for each 1000 MW of electricity required. Appropriately spaced, so they would not wind from one another, they would require an area of about 13,000 square miles. Estimates, based on the actual cost of windmills built in Denmark in 1957 with allowances for inflation, indicate a capital cost of about $5000/kWh (output, not rated). Under these conditions, power costs would be in the range of 70 to 100 mills/kWh excluding the cost of the storage system. In a recent study

Ontario Hydro estimated an energy cost of 90 to 100 mills/kWh for conditions somewhat more optimistic than those we chose.

Wood is a renewable fuel and some preliminary studies have been made on the use of wood to produce electricity. Szego and Kemp of Intertechnology Corporation have calculated that a 1000 MWh plant would require an energy forest of about 1000 square miles in the Southern United States. We have done a similar calculation for growth rates appropriate to the area around North Bay, Ontario, and have arrived at an area of about 8000 square miles. Up until now I have been unable to find any information on the cost of harvesting the wood, consequently I have been unable to arrive at any estimate, that I can quote with confidence, on the potential cost of energy. The pertinent information should be available from pulp and lumber companies and should be collected. However, the areas are so large that, on the surface, the concept does not seem practical for large-scale electricity production.

I have also made some very preliminary calculations on the extent of Canada's wood resources. If we assume that the energy yield and growth rates for the North Bay area represents the average yield for the forested areas of Canada we find that Canada's forests will produce roughly 0.8 Q or on a renewable basis about 0.01 Q per year. This is a large resource but much more information on costs, the value of the wood for alternative purposes, and ecological effects is required before we can assess its applicability. As we all should recognize it has application in isolated areas but intuitively I believe that the problems mentioned above will

limit its application to these areas.

Tidal and geothermal generation of electricity are practical and will almost certainly be economical in some locations but the areas of application will be limited and these technologies will not likely play a very significant role in the overall picture. Consequently I have not attempted to obtain any detailed information on these technologies.

In Table 7, I have summarized the costs of the various alternatives for the production of electricity. The costs do not include the cost of distribution. In all cases I have used costs that are approximately valid for facilities going into service in 1976 and have assumed public utility financing.

Table 7

Estimated Costs Of Alternatives Methods Of Producing Electricity

(1976)

Nuclear	~ 11 mills/kWh
Coal (Ontario)	~ 20 mills/kWh
Coal (Alberta)	~ 12 mills/kWh
Solar Thermo-electric (Without Storage)	~ 50 mills/kWh
Solar Photovoltaic	~ 500-1000 mills/kWh
Wind (Without Storage)	~ 70- 100 mills/kWh
Wood	?

We have looked in a general way at the effects of inflation on all of these alternatives and although the effects are likely to differ, the difference is not likely to be sufficient to change the overall

picture. You can see that coal and nuclear are likely to be the most economical ways of producing electricity in the future with the choice between the two likely to be dictated by proximity to coal supplies. The other alternatives that I have been able to evaluate do not appear to come close.

(2) Space Heating (25%)

Now let us turn to the space heating requirement. If you recall the first table, space heating represents about 25 percent of our energy utilization and this requirement is now primarily met by oil and gas. I will deal with future costs of oil and gas in a subsequent section. In this section I will concentrate on alternatives to oil and gas for space heating.

We are all aware that electrical energy is now selected for many space heating applications over oil and gas so we must conclude that it is close to competitive and is clearly a viable alternative. Our analyses show that, under certain assumptions, which I would assess as optimistic but certainly not ridiculous, solar energy is competitive with electrical energy for space heating so we must consider solar energy as a viable alternative as well. In this section I want to give you the basis of this solar/electrical comparision then I want to mention briefly heat pumps and district hot water heating from a central station. I am sure none of us want to go back to shoveling coal or chopping wood, even though it might be good for us. Consequently I have not included these in my list

of alternatives for this application. If the other alternatives become prohibitively expensive, coal may be reconsidered but I doubt if this will occur and in any event I will be dealing with the cost of coal in a later section.

I have seen several ways of comparing the cost of solar energy with electricity for space heating but from my point of view the person who is eventually going to decide on the practicality of any alternative is the customer. Therefore we have made our comparison as best we can as it will be seen by the customer. We have compared both the initial capital and estimated lifetime costs of an electrically-heated home in Winnipeg with those for homes that are heated 70% by solar energy and 30% by electricity and 100% by solar energy. The 70 percent solar home has a three-day heat storage system while the 100 percent solar home has a summer/winter storage system. The house requires about 54,000 kWh of energy each year and has a peak requirement of about 15 KW in mid-January. Our studies show that Winnipeg is one of the more favorable locations in Canada for solar heating because of its low incidence of cloud cover.

The basis of the comparison is as follows:

(a) The electricity to the home is supplied by a nuclear electric generating station that went into service in 1976 and an electrical distribution system built in 1976. The utility borrowed money at 8 percent interest and is amortizing the station and the distribution system over 25 years. The operating and maintenance components of the cost of electricity escalate at 5 percent per year due to inflation. These assumptions result

in an electrical rate in 1976 of 21.5 mills/kWh which is higher than experienced today but is reasonable for the comparison being made.

(b) The homeowner takes out a 25-year mortgage at 9.4 percent to pay for his home. This rate is consistent with the 8 percent rate to the utility and both are generally consistent with a 5 percent rate of inflation.

(c) The solar panels cost $5/ft^2$, deliver 50 percent of the energy of insolation as useful heat to the house, and last for 25 years. The three-day storage system costs $1700 including plumbing and the summer/winter storage system costs $9000 including plumbing.

(d) If a significant fraction of the space heating load is provided by all electric or 70 percent solar/30 percent electric systems this would probably distort the electrical system resulting in a reduction in utilization of capital plant. The cost of this reduction would affect the cost of electricity. I will give an estimate of how this distortion might affect the comparison. In this estimate it is assumed that a north/south grid is in operation and the electricity is used in the southern part of the grid for air conditioning in the summer.

Table 8 gives a comparison of the capital and lifetime cost to the homeowner for the three heating concepts. The costs of lighting and other miscellaneous electrical loads are included in the lifetime costs because they are difficult to exclude from the calculations. The capital cost of the heat distribution system is excluded because it is common to all systems.

Table 8

Comparison Of Capital And Lifetime Costs
For Electrical And Solar-Heated Houses

(Dollars)

Home	All Electric	70% Solar/30% Electric	All Solar
Initial Capital	$ 600	$ 6,000	$ 13,400
Lifetime Cost	33,400	33,300	45,400
Lifetime Cost*	37,000	40,200	45,400

* Estimates include the effect of reduced capacity on cost of electricity.

You can see that for the assumptions made solar energy is competitive with electricity for space heating and if these assumptions are valid, solar energy is a viable alternative for this application. The only way I know of testing the assumptions is to build some solar houses and collect data from them. That seems to be what is being done. One of the critical assumptions is the cost of solar panels. We calculate that, if the solar panels cost $\$10/ft^2$ rather than $5, the capital and lifetime costs of the 70/30 and the all solar systems are $10,200 and $46,500, and $17,600 and $57,500 respectively.

An alternative that appears to me to warrant more attention than it seems to be getting is electrical heating (and air conditioning) via a heat pump. I am no expert on heat pumps but engineers whose opinion I value tell me that they are considering installing heat pumps now. The advantage of course is that the heat pump, at least in Southern Ontario, should be able to deliver heat at about half the electrical load of an

all-electric system and should be readily convertible into an air conditioning unit in the summer. Short term storage systems would allow a lot of flexibility for electrical system load leveling. J. A. Horvath of McMaster University has proposed the development of a heat pump particularly suited to Southern Ontario conditions. I am advised that most heat pumps today are designed to be air conditioners first. Apparently it would be better in Canada to have a heat pump designed to be a heater first. Existing heat pumps now cost $3000 - $5000 depending on capacity and using their costs and characteristics Horvath calculated that the extra cost of the heat pump on a heating/air conditioning system would be paid back in three to seven years through savings in the cost of electricity. Most of my engineers who have looked at the alternatives for the future consider this to be the most attractive.

We have also studied district heating systems assuming that two different types of nuclear unit at the Pickering location supplied 600 MW of thermal energy to a distribution system in the city of Toronto. One of the units was a 706 MW unit which produced only heat. The other unit was a 2200 MW thermal unit equipped with a back pressure turbine which supplied 706 MW of thermal energy and 438 MW of electricity during on-heat periods, and 640 MW of electricity during off-heat periods. The heating costs from both units are compared with electrical resistance heating costs in Table 9.

Table 9

Comparison Of District Heating
With Electrical Resistance Heating

	Thermal Only	Thermal/ Electric	Electrical Resistance
Reactor Core Size MWt	706	2200	-
Thermal Power Supplied MW	600	600	600
Overall Energy Utilization %	85	36.6	27
System Load Factor %	35	80	68
Nuclear Station UEC[1] mills/kWh	9.2	4.4[2]	-
Pipeline UEC mills/kWh	7.9	7.9	-
DHS Grid UEC mills/kWh[3]	3-24	3-24	-
Total UEC	20.1-41.1	15.7-36.7	30.1

1 UEC = Unit Energy Cost.
2 Portion charged to district heating.
3 Low number assumes a few large customers; high number assumes many small customers.

It was assumed that the units were started in 1974, and went into service in 1979. The resistance heating costs were based on 1974 electrical rates escalated at 10 percent per year to 1979. The study showed, as one would expect, that the lower capital cost and better fuel utilization of the thermal-only unit was counter-balanced by its much lower capacity factor. Consequently the thermal/electric system showed a slight economic advantage over the thermal-only system. The competitive position of both in relation to resistance heating was dependent on the cost of the hot

water distribution system. These already exist in several European cities and district heating is quite extensively used there. However, they do not now exist in Canada and it is questionable if they can now be economically installed here in competition with the other available alternatives.

In summarizing the space heating situation, we can conclude that electrical energy is a demonstrated alternative to oil and gas and solar energy is a potential alternative. The electrical alternative can probably be made more economical in most of the heavily populated areas of Canada through the use of heat pumps. Direct district heating using either nuclear or coal-fired stations to provide the heat is practical but the cost and inconvenience of installing a hot water distribution system will probably restrict its use in Canada.

(3) Industrial Energy Other Than Electric (30%)

Now let us turn to the industrial requirement. Again if you recall Table 6, this industrial requirement represents about 30 percent of our energy utilization. In 1974 we made a survey of the use of energy (excluding electricity) in industry and found that about 90 percent of the requirement was for low pressure steam, i.e., steam at about 100 psi or less. We found that this was required primary in 20 to 80 MW blocks and is currently provided primarily by oil and gas. In a number of areas, however, it is provided by burning waste products. The pulp and paper industry burns a lot of its waste products and I think supplements this with either oil or coal.

Although the nuclear industry has put a significant effort into the development of small reactors, and has developed small reactor systems for application in space, it has not been able to come up with a concept that appears to be economical for wide-spread industrial use. The only possible way that nuclear energy could now be economically used to meet this requirement is to group a large number of industrial users around a station producing at least 1000 MW thermal and this is not practical for most of our industrial applications.

Consequently the best practical alternative to meet this need seems to be coal. Coal can be produced at the mine head in Alberta for $0.30-$0.60/MBtu, depending on the type of mine, but it costs about $0.85/MBtu in Winnipeg and about $1.90/MBtu in Toronto. It seems axiomatic then that extensive programs on improved methods of transporting coal, perhaps in existing pipelines, and in treating the off-gases from coal combustion, would pay off handsomely for the future. Also coal is going to need a competitor to prevent its price from simply following the market price for foreign oil, frontier oil and gas, or synthetic oil and gas. At the moment I do not know what that competitor is going to be.

The summary then the alternative for industrial energy is pretty simple; coal.

(4) Transportation And Farm Equipment (28%)

Now let us turn to the transportation and farm equipment requirement which represents 28 percent of our total energy requirement and is again almost entirely met by petroleum products. This one is difficult.

At the present time we do not have a good substitute for petroleum and I am convinced that in the not too distant future Canada is going to have to depend on oil recovered from the tar sands. The basis for my statement is a series of studies we did in 1972 which compared the cost of frontier gas, synthetic natural gas from coal gasification, and nuclear generated hydrogen on a comparable basis. The part of the study we did in some detail was the cost of nuclear generated hydrogen. I have updated those numbers to take account of inflation and have compared them with more recent numbers we have obtained for the other alternatives. These approximate cost numbers are given in Table 10.

Table 10

Comparison Of Estimated Costs For Frontier Gas and Oil, Oil From The Tar Sands, Coal Gasification And Nuclear Hydrogen

	Estimated Cost $/M Btu	Estimated Cost $/bbl Oil Equivalent
Frontier Gas and Oil	2.20	13
Oil from the Tar Sands	2.60	15
Coal Gasification	4.00	23
Nuclear Hydrogen*	5.50	32

* Assumes electrical cost equivalent to Pickering B.

You may wonder why I say we are going to have to depend on tar sands oil when the estimates for frontier gas and oil are cheaper. The reason is simply that we know it is there. We know the tar sands deposits contain about 700 billion barrels of oil and we expect that approximately

half of this will be economically recoverable. If we find extensive oil or gas resources in our frontier areas we should certainly use them. However, we should not neglect the development of the pertinent tar sands technology in the hope that the frontier areas will meet our requirements. There should be enough oil in the tar sands to meet our transportation needs for at least a couple of centuries. Although the costs of oil from the tar sands seem high it should not cause us serious economic difficulties, particularly if we substitute coal in many of our industrial uses. Many Europeans these days pay twice as much as we do for gasoline and many of them seem to be surviving economically very well.

In summary then we can say that in future our transportation needs could be met by frontier oil or oil from the tar sands, with oil from the tar sands favored in my view because of its known abundance. The other alternatives may come later but the need for them is likely a couple of centuries away.

Conclusion

Perhaps in conclusion I could outline to you my plan for Canada's energy future. It is a pretty simple one and is as follows. Use hydro and nuclear energy to produce electricity and let electrical heating take over the bulk of the space heating load; let coal take over the bulk of the industrial energy demand wherever it is economical for it to do so; use our conventional oil and gas primarily in our transportation sector

and develop tar sands technology to replace conventional oil and gas resources when they are gone.

I do not advocate that such a plan be put into force by legislation or that we should discourage studies of other alternatives. For example solar energy might prove attractive to carry some of the space heating load and tidal power could make a significant contribution to the electrical load in Canada if it proves to be economic. However, I believe that we should recognize that the plan I outlined is a potential solution to our future energy needs and avoid putting roadblocks in the way of allowing it to happen as a result of natural economic forces. In Canada we are fortunate; we have practical energy alternatives. All we need is the common sense to develop them and use them wisely. Thank You.

Discussion

Avrum Regenstreif - Assistant Secretary
Planning Secretariat of Cabinet
Government of Manitoba

It seems to me when we are looking at numbers, that sometimes there is a little danger of jacking some of those numbers up a little bit and I think one of those numbers is in your paper. You use the number 1.2 Q. I did a quick calculation based on transposing Canada's current per capita energy use to something akin to say Sweden's current per capita energy consumption and multiplied that by 10 billion, the estimated level at which the population of the world will stabilize and I get something like 1.44 Q. Given that number and given that fact that the developing countries will very probably be developing more rationally or hopefully more rationally than we have done in the past, how does one get to an estimated consumption of 6 or 10 Q in the near future? Another question is how does one - and this perhaps is more applicable to the U.S. situation than in Canada - provide a competitor of coal when coal and oil companies are in fact the same companies? The third question is what studies can you cite to prove that it is questionable that district heating cannot be economically installed, particularly in new growth areas of some of the cities in Canada?

Bob Hart

I am quoting numbers that have been proposed by a number of other people as to what might happen. I used 3 Q in my assessments because I do not particularly believe the 6 or 10 Q ones. If we were to use the

1.4 Q as you suggest I do not think it would change the picture very much. All it would do would be to delay the time when we would need additional substitution somewhat. Now the second question had to do with - can you give me the second one again?

Avrum Regenstreif

Maybe it is a rhetorical question but it had to do with the problem of how does one provide a competitor to coal when coal and oil companies, or coal and natural gas companies, in some cases, are one and the same thing?

Bob Hart

All I can say is that I wish I knew because I am dead certain that if there is not competition then what will happen is that the price of coal will go up pretty close to the price of oil. There are people here that are better economists than I am but I saw a few people nodding their heads when I made that statement. I think we have to look at alternatives to that possibility. I just do not have an answer at the moment, except possibly the ones that I have already suggested.

Avrum Regenstreif

The third question had to do with the statement that has generally or very commonly been made in many sources, namely what studies can one cite to indicate or prove that it is questionable that district heating can be economically installed or begin to be economically installed

particularly in urban growth areas in Canada?

Bob Hart

I do not really have some good economics on that. We participated in some research on this matter in connection with a study that was being done for a certain area in the city of Toronto and I believe that is where the numbers in Table 9 came from. I should say that some of my staff would disagree with me on my conclusion that district heating does not seem to be competitive; they would not be as pessimistic as I am. I think the reason for that is they believe that even if you do have to pay a bit more money for the district heating system, it is still worthwhile installing because of better fuel utilization. Clearly you will get better fuel utilization. I guess it is a question of what you use to produce the hot water. If you use nuclear fuel and you have a lot of it or if you can find some way to use solar heat to produce that energy (which is renewable) then you will not be as concerned about the fuel utilization rate as you would be if you are using something that is quickly depleting.

Evan Pepper - Professor of Botany
Brandon University

Mark Twain once said that figures do not lie but liars can figure and I would like to take exception to some of your calculations on energy costs. One thing that nuclear people tend to do in addition to being very defensive about nuclear power at the present time and rising to the

bait when somebody mentions dirty words like 'plutonium' 'fall-out' and 'radioactivity' - present company excepted - is to under-estimate the real costs of power generation by nuclear means. They never take into account, for example, the enormous amounts of money that have gone into nuclear research,partly for weapons development, partly for basic research and partly for power generation for peaceful needs. Those figures never show up because all too frequently they are hidden anyway. They were hidden when they were first appropriated by government both here and elsewhere. Secondly at the other end they never take into account the presumed costs of maintenance of waste disposal systems for radioactive materials that presumably are going to go on perpetually. It seems to me that if you are going to talk about nuclear power being competitive or indeed cheaper than other sources of energy then these costs ought to be reckoned with a little more carefully than they actually are. I wonder if you would comment on that?

Bob Hart

Yes, I think we have pretty good numbers on the cost of management of wastes. The calculations done are based on setting up a perpetual care fund during the life of the plant and those costs have been estimated to be 2/10 of a mill per kilowatt hour. I think they are very reasonable estimates. We have also done a quite detailed study on the decommissioning of reactors and you can take decommissioning to three stages. Let us take the stage where you remove the unit completely and convert it to a parking

lot; that again would cost approximately 2/10 of a mill per kilowatt hour.

Your question on the cost of R & D is certainly a valid one but I would come back on that question with another question which is: do you write off R & D costs over the 12,000 megawatts that exist now or the 60,000 megawatts that could exist say in 1998. If you write it off against 12,000 megawatts it makes a fairly significant impact on the cost but if you write it off against 60,000 megawatts it does not.

Graham Yuill - Unies Ltd.

I have two questions. One is about this R & D cost question that was just raised. I am not an economist - I am an engineer - but I have a vague idea that when you are looking at decisions you should be looking at opportunity costs. For this reason I am serious when I ask if you have ever heard anyone suggest how we could get back that R & D money if we did not build any nuclear power plants?

Bob Hart

I think you get back some of it in terms of industrial development and skills that you have increased. I do not think however, you can quantify it.

Graham Yuill

I do not think that it is a cost that can be assessed against future nuclear power plants because it is spent already.

The other question is about the safety of various possible energy sources in the future. I know that in the nuclear business you have detailed records of safety going back through the years and I also know that you have done very detailed analysis of future safety (as you are required to do by the Atomic Energy Control Board). Have you ever seen a similar kind of analysis done for any other energy source that might be used in the future. In particular, I have an interest in solar energy (I am the chairman of the Manitoba Chapter of the Solar Energy Society). I have a vague uneasiness about the fact that the construction industry is a high risk industry and the solar industry is going to be part of the construction industry. Hence, I am curious as to whether or not anyone has looked at the potential dangers of solar energy for instance in comparison with nuclear energy.

Bob Hart

You asked me if I have ever seen a quantitative study of that kind. No, I have not. At the moment the Department of Energy Mines and Resources is in fact attempting to do a comparison of environmental effects of all of the energy alternatives. Although I do not know all the ones they have included, I do know that they have included coal, oil and nuclear energy. The only problem I see is that they were asked to complete it by the middle of May and there is no way they can do a good job by the middle of May. I think the answer to your question is no but it is something that should be done.

John C. Williams - Member
Manitoba Research Council

I am a member of the Manitoba Research Council and also with the Tantalum Mining Corporation. I have two questions. I noticed on Table One of your paper you have listed the energy potential for nuclear fusion to be I believe it was, 10^9 Q. From what I understand, the nuclear energy alternative is also dependent on the supply of lithium. You have also noted in a footnote to that table that the lithium supply is calculated to a depth of one mile on the earth's crust. Within the last year there has been a conference convened in Denver by the U.S. Bureau of Mines on the actual availability for lithium. The results of their study was that there would be no lithium left by the year 2000. I wonder whether those two figures are at odds and where the information that you have came from. This conference is being continued or reconvened again in October in New York and I intend, once again, to go into this study. My question is, is there a difference in these figures and your figures and where did your information come from?

Bob Hart

I suspect that the numbers from the study you speak of refers to the proven supply of lithium, but I am not absolutely certain. My number in the table is a pretty rough number. It is based on an assumption - I think I quoted the assumption in the paper - that the amount of energy is limited by the availability of lithium and some very crude assumption that you can recover the same amount of lithium as you can recover of

uranium and thorium. It is not a very good defensible number in that regard but it is all that I was able to get at the time.

John C. Williams

That answer illustrates the importance to that convention up-coming this October in New York.

The second question has to do with the costs of producing electricity and the different methods that you went through. We have had some contact with a method of producing electricity that is called the Magneto Hydro Dynamic Method. We understand that in Russia there are one or two plants that are operating and are producing electricity by that method. Now knowing very little of it technically,my question to you would be; why have you not included this in your method of generating power and perhaps you could comment on the liability of it or the inadvisability of it.

Bob Hart

Well we need a Hydro Dynamicist.I guess there are people here that can talk about it better than I can but it is a way of burning primarily, I would say, coal more efficiently. It uses cesium as a carrier gas in the exhaust system, if I remember correctly, to do this. What it would do, if it in fact became practical (and I think that the problem at the moment

is that the materials technology does not yet exist to run those plants for very long) would be to extend out the coal resources by perhaps 30%; that is a guess. Is there somebody here who can give me an additional number?

George Bowman - Assistant Deputy Minister
Industry and Commerce
Government of Manitoba

I want to make a general observation and to criticize the cavalier use you made of all those figures. There is very little in your paper that relates one figure to another. You talk of time in scales; you mention the end of the century and then you say that there is no sign of anything significantly new coming along for hundreds of years. You talk about the energy consumption on this earth being increased to provide the same standards of consumption, the same level of consumption across the world but you do not talk about how this is ever going to be achieved. I mean to question the relevance of all this in terms of this seminar's topic which is the Conserver Society. There is very little that you have mentioned that related to a Conserver Society. When you say that nothing significantly new is going to appear for hundreds of years you do not consider the possibility of,for example, the kind of research money that is going into nuclear, going into something like solar. I suggest that if we had a research organization looking after solar interests just as A.E.C.L. is looking after the nuclear one, nuclear would have another competitor in the field, another very serious competitor in the field.

I think that the most encouraging thing that I have to say - and it does relate to the Conserver Society - is in reference to that section of your paper where you paraphrase Gordon McNabb. I am very encouraged to think that Gordon is now talking of conserving perhaps twenty-five percent and possible even fifty percent of the increase in energy consumption. I know that six or seven years ago Gordon would not even consider conservation at all.

Bob Hart

I think that my comment on all that,is that the paper I presented here is what I was asked to present; namely what I saw as the cost of energy for the future. I think that such an emphasis is extremely relevant to conservation. I believe that in fact, it is primarily through costs and increasing costs, that you are going to achieve conservation. I think, George, it is a fallacy to think that you can make any technology practical simply by pouring money into it. There are some fundamental rules of science that, in fact, prevent this. I do believe and as I have said, that the practical application for solar energy is in space heating which is twenty-five percent of our total energy consumption. If we can pull that one off - develop solar energy for space heating - then I think that we will have done a tremendous job.

I may be accused of throwing around numbers and of having them a little bit out of context but the only way that we can think about the problem is in terms of numbers and I think the most appropriate numbers are the ones expressed in terms of today's dollars. I believe it is better

to think of the things in terms of numbers, quantities and dollars. You can get fooled by qualitative assessments.

Graham Smith - Professor of Management
McGill University

I agree with you. I think you have to put these into numbers but have you not also got a bit of a fallacy in your argument in the sense that you are assuming supply will create a certain demand. I do not see anything in your paper about dampening these pressures down on the demand side. This is presumably what conservation is all about.

Bob Hart

I think that we are beyond the point where supply creates its own demand. The utilities themselves, as you know now, as far as I can see are not in fact trying to push increased use of their products because they are having trouble raising capital. The other thing that I would say is even if we achieve that fifty percent figure we are still going to have an energy gap. I think that we had better realize that fact.

Graham Smith

I have one subsidiary question. Is it not true that the utilities are still charging the individuals who use the most the least on a per unit basis and is not this in effect something that is a residual of the days when supply had to create its own demands?

Bob Hart

I think that it may be a residual but if you want to watch your utility price structure you have got to argue it with the utilities and not with me.

Tom Pepper - Executive Director
Saskatchewan Research Council

Partly a question, partly a comment: the answer may be buried in the tables on energy resources but what I would like to see sometime is amongst all these tables of the energy resources another column indicating the necessary consumption of energy to make that resource available. What we really want is the residual energy associated with these resources. Sometimes you may have a hunk of coal sufficiently far down in the ground that it takes more energy to get it up to the top than it is worth. I think that it would be very nice, and probably you have got some numbers on this, to know what the actual available residual energy resource is considering the physical constraints and the technological constraints.

Bob Hart

I can give you some rough numbers on that. We have looked at that question and I cannot say whether all of these things are all inclusive, in particular I cannot say whether it is all inclusive in the coal industry. The numbers that I have seen for the coal industry is that the pay back period (that is, the operation of a plant takes a certain amount of time to pay back the energy that went into it) in just about all of the tech-

nologies run in the neighbourhood of 1 to 3 years. For the ones that we have looked at and if I remember correctly, coal was slightly less than 1 year, nuclear was between 1 and 1.5 years. Some people at a nuclear symposium a while ago said that the pay back period for solar receptors was eight years. We looked at that and our numbers were something between 2.5 and 3 years. What I cannot say is whether or not the pay back period for coal includes the energy that went into the mine or for that matter the nuclear one either.

Leonard Remis

Thank you very much Dr. Hart. I was not able to accommodate some of the other questions due to time constraints. Hopefully they can come up during the discussion of the papers yet to be presented.

4.

CANADIAN FOOD PRODUCTION: FUTURE CAPACITY AND ADJUSTMENT

Professor Leonard B. Siemens
Associate Dean
Faculty of Agriculture
University of Manitoba

I. Introduction

Dr. Lester Brown of World Watch Institute, Washington, D.C. argues in most of his articles written during and after the food crisis years of 1973-75 that the world food-population relationships have undergone a "fundamental transformation" and will never again return to the more stable and predictable conditions of the pre nineteen-seventies. It appears from the letter of invitation of this seminar, signed by the chairmen of the two sponsoring agencies, that our national and provincial economies, and perhaps even our ecologies are also undergoing 'fundamental transformations' to which society's values, expectations and responses have yet to adjust. One of the purposes of this seminar, it would then appear, it to examine some of the old assumptions that have heretofore guided our collective social and economic lifestyle with the view to arriving at assumptions and behaviors much more in harmony with the current realities of the natural and economic systems of the 1970's and thereafter. The seminar sponsors believe that adaptations of the Consumer Society Movement may find a place in tuning our current troublesome discords and in again finding harmony in the new, transformed environment.

My assignment is to examine the extremely broad topic of food production in Canada in the context of the new constraints and opportunities that future decades are likely to present. Because of the awesome scope of this undertaking and the limited presentation time, I shall confine my discussion to major food categories derived from Canada's land base.

Although it is a significant food category, I will not attempt to include fish and related sea-foods in this paper.

In keeping with my topic, I shall present some estimates on Canada's potential food production capability by the year 2,000 and then I will present some projections of actual production forecasts and resource use estimates for 1985. Next I will offer some opinions on possible adjustments in agriculture that relate to environmental and economic constraints that are currently emerging and likely to intensify in future decades. A final section will speculate on opportunities for enterprise that Canada's agricultural future might hold.

II. Estimates Of Canadian Agricultural Production Capacity By The Year 2,000

A. Canada's Land Resource

There are, of course, two ways by which agricultural production can increase, namely, by extension of the land base and by the intensification of management. A review of Canada's land resource is, therefore, a logical first step in projecting the total Canadian production capacity. Fortunately, we have the immense data bank of the Canada Land Inventory (CLI), which began in 1963 and is now nearing completion, to draw upon. A summary overview of Canada's land resource, as distilled from the CLI by soil scientists of Agriculture Canada, is presented in Table 1.

Table 1

Summary Of Land Resource Information

(millions of Hectares)

	Agricultural Capability			Non-Agric.
	Classes 1-3	Class 4	Classes 5 & 6	Class 7
	Suitable for cultivated agric.	Marginal for cultivated agric.	Suitable for rough grazing	Not suitable for agriculture
A) Total Land Resource with Agricultural Capability.	47	25	40	0
B) Land Improved and Used by Agriculture.	31	7	4	1
C) Unimproved Land Used by Agriculture.	5	3	8	1
D) Land with Agricultural Capability Not Currently Used by Agriculture.	4	10	18	0

NOTE: Partial data only, components will not add to the total.

Source: Information from Canada Land Inventory (CLI)

(Personal Communication: Dr. W. S. Ferguson, Ottawa)

This table indicated that of the total 72 million hectares of land that is either suitable or marginally useful for cultivated agriculture (Classes 1-4), 38 million have been improved and 34 million remain unimproved. However, of the 47 million hectares which are classed "suitable for cultivated agriculture" (Classes 1-3), 31 million are improved and 16 million remain unimproved. It is important to note, however, that a considerable proportion of the unimproved components of classes 1-3 land may be only 50 percent as

much of this country's medium to marginal quality land still lies in a virgin state. Later discussion on Canada's maximum food production capacity will presume upon the land resource potential discussed in this section.

B. Canada's Food Production Capacity

During the past five years, a number of governmental and other studies have been directed at estimating Canada's food production capacity. Many of these studies are still in progress. The most recently available estimates, which appear in subsequent tables, were acquired in the course of personal communications from Dr. W. S. Ferguson, an Ottawa soil scientist. Table 2. estimates the future production of Canada's cereal, oilseed, horticultural and forage crops under three different scenarios or assumptions.

Scenario 1, the "trend" projection, indicates a 36 percent increase in cereal crops production with little change in other commodity groups. The High Productivity projection suggests a cereal crop increase over current production of 75 percent; an oilseed increase of 50 percent; a horticultural crop increase of 49 percent, and a forage crop increase of 65 percent. Finally, the maximum potential supply estimate projects the following levels of increase over current production: cereal crops 140 percent, oilseed crops 209 percent, horticultural crops 126 percent and forage crops 90 percent.

F2

Table 2

Future Supply Projections For Canadian Agricultural Commodities

Commodity Groups	Current Production (1970-1974)	Scenario*		
		1 Trend	2 High Productivity	3 Maximum
	Millions Metric Tonnes			
Cereal Crops	34.2	46.4	59.9	82.0
Oilseed Crops	2.2	2.8	3.3	6.8
Horticultural Crops	4.3	4.5	6.4	9.7
Forage Crops (improved land)	30.0	33.0	49.6	57.2

Source: Personal Communication: Dr. W. S. Ferguson, Ottawa.

* Scenario 1. Potential supply estimated by extrapolating 1960-1971 yield trends with crop distribution and areas as reported in the 1971 census.

Scenario 2. High productivity supply situation, assuming a high level of management on all class 1-3 agricultural soils with crop distribution proportional to 1971 census information.

Scenario 3. Maximum potential supply utilizing a high level of management on all land with agricultural capability and rationalizing land use to gain adaptive advantage.

A second set of maximum crop production estimates, somewhat more specific and detailed than outlined in Table 2., is presented in Table 3. This table was also obtained from Dr. Ferguson. The estimated maximum production of six crop categories over actual figures for 1971-73 are as follows: cereal crops 110 percent; oilseed crops 195 percent; grain corn 630 percent; other crops 50 percent, improved hay and pasture 121 percent, unimproved hay and pasture 239 percent. The production estimates assume a 77 percent reduction in summerfallow from 11.2 to 2.6 million hectares

and a 59 percent increase in total land use for cropping and hay and pasture production, from 54.2 to 86.2 million hectares.

Apart from the increase in land use, the estimates of Table 3 anticipate much more intensive management than is currently in practice. This would be achieved by such practices as lowering the proportion of summerfallow (as indicated) and increasing fertilizer use, and by improving such practices as pest control, drainage, tillage, and variety and crop selection. Obviously, these practices would be applied only as production incentives would appear to render them profitable.

Table 3

Comparison Of Current Land Use And Production With Estimated Maximum Potential For Canadian Agriculture

	Current 1971-73					
	Land Use (million ha.)	Production (million M. tonnes)	Land Use	Percent Increase	Production (M.M.T.)	Percent Increase
Cereal crops	17.6	29.6	29.5	68	62.2	110
Oilseed crops	2.3	2.3	4.8	109	6.8	195
Grain Corn	0.5	2.7	3.0	500	19.5	630
Summerfallow	11.2	-	2.6	-	-	-
Other crops	0.4	-	0.6			
Improved Hay & Pasture	6.2	25.9	11.7	89	57.2	121
Unimproved Hay & Pasture	16.0	10.9	34.0	112	157.2	239
Total Land Use	54.2		86.2	59.0		

Source: Personal Communication: Dr. W. S. Ferguson, Ottawa.

Table 4. estimates the feed requirements to supply domestic demand for livestock products by the year 2,000. Based on a continuing rise in standard of living and a population of about 30 million by the year 2,000, this table suggests an increase in forage feed for "all forage beef" of 136 percent, and an increase in forage needs for grain fed livestock of 131 percent. Respective increases in cereal grain needs for forage beef and grain fed livestock are projected at 67 percent and 99 percent.

I have not attempted to re-calculate these figures, but have presented them as about the best informed estimates of this nature currently available in Canada. I am deeply indebted to Dr. Ferguson for making them available.

Table 4

Current And Future (Year 2,000) Feed Requirements To Supply Domestic Demand For Livestock Products

(million metric tonnes)

	Forage (dry basis)			Cereal Grains		
	Current	Year 2000	% Inc.	Current	Year 2000	% Inc.
1. Total Consumption: (all forage beef)	37.5	88.4	136	6.1	10.2	67
2. Total Consumption: (grain fed livestock)	32.1	74.2	131	9.2	18.3	99
3. Total Production	73.1	214.4	192	29.6	62.2	110

Source: Private Communication: Dr. W. S. Ferguson, Ottawa.

III. Canadian Agriculture - 1985

A. Acreage and Production Projections

While maximum productivity estimates, such as presented in the previous section, provide both useful and interesting information, the authors of these estimates would be the first to admit that maximum national production projections are highly speculative and rather academic.

A somewhat shorter-term set of Canadian food production models appeared in the Winter, 1977, issue of the Agrologist, published by the Agricultural Institute of Canada, in Ottawa. This presentation undertook to project to 1985, the actual production of most classes of food grown in Canada. The study was co-ordinated by Dr. Alvin E. Hannah, Assistant Deputy Minister of Agriculture Canada. Authorities in respective specialty areas prepared the material.

I present for your consideration, a summary of each of these projections without comment. I trust my summaries have not distorted the intent of the authors. For the full text on each section, I refer you to the most recent issue of the Agrologist.

1. Cereal Grains and Oilseed - by Harry Leggett (Agriculture Canada).

* "Acreage of wheats other than Hard Red Spring should remain constant."
* "Canada will need about 22 to 25 million acres of Hard Red Spring wheats each year up to and beyond 1985."
* "Flax ... will continue at about 1975 levels of production."
* "Soybeans are not likely to expand in South-Western Ontario, but earlier varieties could encourage increased production in other parts of Canada by 1985."

* "Sunflower production increases will probably be slow, although potential exists for increased production in parts of Western Canada."

* "Rapeseed prospects are bright for the production of from 4 to 5 million acres by 1985 if competitive advantage can be maintained through technological advances."

2. Red Meat - by David M. Adam (Secretary Treasurer of Meat Packers Council of Canada)

* By 1985 More Canadians will be eating more red meat. The following demand projection by S. Barewal of Agriculture Canada seems to Mr. Adam as a reasonable estimate of per capita consumption by 1985.

	1975	1985	% Increase
Beef	102.3 lbs.	114.5 lbs.	11%
Pork	48.4 lbs.	67.5 lbs.	39%
Veal	5.4 lbs.	4.6 lbs.	-17%
Mutton	2.9 lbs.	5.8 lbs.	100%

* "Given a reasonable break, Canada will produce red meat to the 1985 projected consumption, will participate modestly in pork export markets, and still continue a major grain exporter."

3. Poultry and Eggs - by Peter Quail and Donald McQ. Shaver
(Shaver Poultry Breeding Farms, Cambridge, Ont.)

* Egg Production, according to Agriculture Canada, is expected to follow population growth fairly closely to 1985. A per capita consumption of 222.9 eggs is predicted. However, because of increased productivity per chicken, the number of laying hens is not likely to increase in proportion to anticipated egg production.

* An increase of 23 percent in chicken meat, and 10 percent in turkey meat can be expected.

* However, if an increasing share of Canadian grain production is exported for human use, it is likely that prices for all meat commodities will rise at a faster rate than income. This could result in lower per capita consumption of eggs and poultry meat than projected.

4. Horticultural Crops - by John Vandenberg (Agriculture Canada)
and William Daman (Canadian Horticultural Council)

* The 1975 fruit and vegetable acreage and production and projected estimates for 1985, are presented by the authors as follows:

Acres		Production (million pounds)	
1975	1985	1975	1985
700,000	849,000	10,500	12,700

* An increase in export sales of both storage and cool season vegetable crops in expected. Increases in fruit production is likely in blueberries, raspberries, strawberries and apples. Other fruits likely to remain stable.

5. Special Crops - by David Durksen (Agronomist, Continental Grain Co. Winnipeg)

* The 1976 acreages and production of selected special crops and the author's estimated projection for 1985 are presented below:

Crop	1976 Actual		1985 Projected	
	Acreage	Production (metric tonnes)	Acreage	Production (metric tonnes)
Mustard	120,000	44,000	300,000	136,000
Sugar beets	80,000	1,090,000	300,000	5,400,000
Buckwheat	40,000	11,000	75,000	34,000
All pulses	227,000	126,000	865,000	657,000
Safflower	-	-	500,000	340,000
Coriander	300	100	1,000	800
	467,300		2,041,000	

6. Milk and Dairy Products - by Gaetan Lussier, (Quebec Dept. of Agriculture)

* Changes in the eating habits of Canadians may be accentuated over the next decade and will maintain the consumption of milk and dairy products at a level only slightly higher than at present. "Milk production in Canada will not vary to any great extent in the course of the next ten years."

* The trend in the reduction of butter consumption should be offset by an increase in per capita consumption of milk in the form of yogurts, cottage cheese and desserts.

III. B. Resource Use Estimates

In the same issue of the agrologist, the expert staff of Agriculture Canada (with assistance from Consumer and Corporate Affairs) performed the additional service of calculating current and predicting the 1985 level of resource use in Canadian agriculture. Again the individual resource projections on energy, fertilizers, chemicals, machinery and equipment, farm labor, and capital and credit, are authored by professionals working in the respective areas.

The assumptions employed in these projections appear to vary from attempting to give due weight to current energy realities and environmental sensibilities to straight line projections from the past. This presentation in the Agrologist was co-ordinated by Dr. Ian Furniss of the Economics Branch, Agriculture Canada. In his introduction, Dr. Furniss stated that inputs from the non-farming sector used on Canadian farms has increased from about 30 percent in pre-war years to almost 55 percent today.

Energy - by Brian H. Davey (Consumer and Corporate Affairs)

* Farm energy expenditures from 1968 to 1972 averaged $260 Million Expenditures in 1975 were $527 Million.
* In 1974 farmers purchased 19.3 Million barrels of gasoline and 7.7 Million barrels of diesel fuel.
* By 1985, if recent trends continue, expenditures could increase to 23 Million barrels of gasoline and 14 Million barrels of diesel fuel, increases of 20 percent and 80 percent respectively over 1974.
* The current energy situation, and Canada's energy policy and strategy are considered in this analysis.

Fertilizers - by C. D. Crober (Agriculture Canada)

* Annual outlays by Canadian farmers for fertilizers and limestone now approach $500 Million, representing about 7 percent of total farm operating expenses.

* During the past two decades, consumption of nitrogen has grown annually by 10.5 percent, phosphates by 4.8 percent and potash by 4.1 percent.

* Projecting these growth rates to 1985 implies:

  1.5 M. tonnes Nitrogen (600 tonnes in 1976)

  1.0 M. tonnes Phosphate (550 tonnes in 1976)

  .5 M. tonnes Potash (230 tonnes in 1976)

* These amounts are all within the current capacity of the Canadian fertilizer industry.

Chemicals - by E. R. Houghton (Agriculture Canada)

* Farm expenditures for chemicals now amount to $130 Million annually compared with $13 Million in 1951. Current expenditures amount to 2 percent of farm operating expenditure.

* A steady increase in chemical use on farms is expected.

* Intensive future research will continue to be necessary to meet the ever higher standards of human and environmental safety of chemicals while maintaining chemical effectiveness.

Machinery and Equipment - by P. J. Moore and A. N. Book (Agriculture Canada)

* Canadian farmers' investment in machinery and equipment amounts to $6.4 Billion.

* Machinery depreciation and operating costs have amounted to a relatively constant 30 percent of annual farm costs.

* Over 80 percent of farm machinery sold to Canadian farmers are imports, primarily from the U.S.A.

Farm Labor - by W. Jones (Agriculture Canada)

* Total agricultural employment in 1975 was 486,000 persons. Estimated annual decline from 1965 to 1975 is 12,000 persons. Projected total farm employment in 1985 is 366,000 persons.

* More than 50 percent of this decline is expected to result from off-farm migration of farm operators.

* Family farm labor will likely continue in short supply.

Capital and Credit - by M. E. Andal (Agriculture Canada)

Capital* and Credit in Canadian Agriculture, 1966 to 1985

	1966	1975 $million	1985**	Percentage increase 1975 to 1985
Land and Buildings	13,150	32,125	83,125	160
Machinery and Equip.	3,549	6,382	12,055	89
Livestock	2,364	4,024	7,150	78
Total	19,063	42,531	102,330	136
Credit Extended				
Long-term	344	654	1,307	100
Intermediate-term	476	1,199	3,195	166
Short-term	1,201	3,560	11,306	118
Total	2,021	5,413	15,808	86

* Source: Statistics Canada

** Straight-line projection of 1966-75 trends

The main conclusion that can be drawn from the 1985 and the maximum production projections that have been reviewed is that Canadian agriculture will continue to increase its annual food output as well as its annual resource input. The processing and distribution of the outputs and the manufacture and marketing of the inputs will assure a healthy future prospect for agriculturally related business and industry in this country.

IV Agriculture Adjustments In The Conserver Society

A primary objective of this seminar is to review old policies and problems in the light of new realities and prospects. The space remaining in this paper allows for only the most sketchy overview of the possible implications of a conserver ethos on future food production in this country.

I am not sure about the extent to which the authors of the food production and resource use forecasts, referred to earlier, have allowed for future production and consumption adjustments that might result from a growing conserver ethic in our midst. It is possible that some of the straight line projections from the past should have been tilted a bit more in one direction or the other as a result of the doubling and still rising energy costs, and the new sensitivity to the delicate systems of nature within which agriculture does its work.

The most apparent areas within agriculture to which Conserver Society interest might relate are land use, land management and fertility, energy use, and international responsibility. A brief consideration of

each of these topics follows.

Land Use

There is an increasing concern about the continued loss of the best land from agriculture. Based on the decade 1961-71, the rate of loss is nearly an acre for every unit of population increase. Bringing an equivalent number of new acres into production from Canada's unimproved "land bank" does not restore the loss. "New" acres generally are farther away, are more costly to develop, may be only half as productive, and will produce a narrower range of crops than old, lost acres. Land speculation, ownership and use can now be listed among the hottest issues in Canadian politics and the dust will not settle until a fairly wide range of new legislation is in place. However, current indications suggest that pending legislation is likely to protect the interests of agriculture and food production.

Land Management

Ecologists and agriculturists both have a renewed interest in the management of agricultural land. Ecologists have raised questions about the ultimate "environmental capacity" for intensive food production on a continental or world basis. At what point, they ask, will the environment's absorptive capacity for global ecological disruption through continued deforestation, breaking of soil and intensification of crop production be reached or surpassed? Of course, no one knows.

Last December, our Faculty surveyed Manitoban farmers to discover the topics on which they most desired technical information. Soil Management ranked as the area of greatest need. Interest was high in wind and

water erosion control, in water management, and in zero (or minimum) tillage. Questions were asked about the viability of all-out continuous cropping and whether there was need again to take seriously the practice of crop rotation and planting of shelter belts.

The same kind of questions were raised in recent reports on Canadian agriculture and good production prepared for the Science Council of Canada by ecological consultants. Ecologists, of course, go further and call for the application of varying levels of what they call "biological agriculture" or "organic farming" to all of Canadian agriculture. They are very concerned about the increasing levels of chemical application to soils and crops in forms of fertilizers and pesticides, for reasons that are well known. Many are concerned about the ultimate effects of monoculture, such as continuous corn production on the same land in Ontario, with high applications of fertilizers and herbicides. Diversity, they claim, is the backbone of a healthy eco-system. It is nature's insulation against disease, inclement weather and pests. Agriculturists should be sensitive to these concerns and be able to defend the practices they recommend with findings from sound research.

There has long been a concern in some groups of society about the long-term social health of a country in which the rural population in general and the number of farm owners in particular continues to decrease without any end in sight and with a concomitant continuing increase in average farm size. The question has been asked whether the economies of scale in farming might not be different under 1965 prices than they would

be under 1977 or 1980 energy prices. Is there a possibility that under exceedingly scarce and costly energy conditions, such as President Carter predicted for his country a few days ago, that the most economical farm would be somewhat smaller in size than today's average? Is it possible that such smaller farms would depend more for soil nutrients on forage and green manure crops and on barnyard manure than is currently the case? Perhaps such farms would even halt the continuing shift from labor to more capital and non-human energy. Should such developments come about (and they are not completely out of the question), the interests of optimum farm return, environmental quality and farm population would likely converge.

Energy

Possibly the single most important area in which agriculture will have to re-think its old assumptions and make significant adjustments, is in its use and misuse of energy. From 1961 to 1971, direct fuel use in agriculture doubled. This high and increasing rate of consumption obviously cannot be sustained. The rate at which energy input has replaced labor input in U.S. farms is shown in Figure 1.

Under sound leadership from agricultural engineers, the industry, I believe, is beginning to come to grips with the energy question. Howevever, since ready availability of low cost energy comprises the very cornerstone of today's commercial production systems, significant changes may be slow in coming. Our Faculty is moving as rapidly as availability of funds permit in adjusting priorities in research and teaching toward issues respecting energy. The research on methane gas production from animal

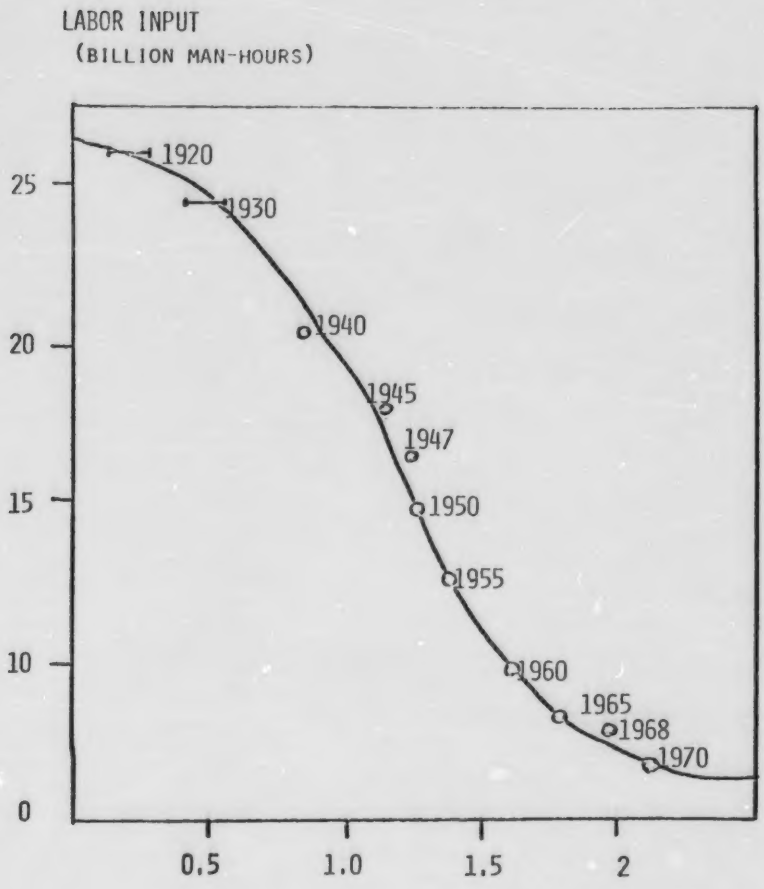


Figure 1. The substitution of energy for labor on U.S. farms

Considering agricultural labour in terms of the time spent producing a unit of output. A New York farmer spent 150 minutes producing a bushel of corn in the early twentieth century. In 1955 it took him just 16 minutes. Today he spends less than 3 minutes per bushel.

waste has received much publicity. The energy saving implication in zero or minimum tillage has resulted in an acceleration of our on-going minimum tillage investigations. Agricultural engineers are developing new criteria for the design and operation of farm buildings and are suggesting countless other energy-saving ideas for the farm. Findings from the multitude of crash energy research programs currently in progress in North America, could lead agriculture into new and unthought of directions.

International Obligations

I am assuming that a conserver society lifestyle encompasses a global frame of reference and is not intent upon developing an insular, protectionist, and increasingly good life for western society only. If this assumption is correct, then an acceptable conserver society ethic would be very concerned about the Third World implications of the policies and practices it recommends for the affluent countries.

This issue has a direct bearing on the extent to which Canadian agriculture might adjust some of its traditional practices in response to the ecological concerns of some citizens. Should our agriculture suddenly reduce drastically its use of energy, chemical fertilizers and pesticide chemicals, and revert to ecologically ideal levels of organic farming as some conserver advocates recommend? Our total food production would be drastically reduced. There might well be a comfortable supply for most Canadians, but our surplus, if any, for off-shore customers

or Third World recipients would either be severely curtailed or entirely eliminated.

I would suggest that we extend our understanding of ecology from that of a closed community, regional or national system, to that of a world-wide "eco-mega system", which assumes that all resources, be they energy, nutrients, land or people, are inter-connected, and isolated decisions cannot be made about any of them.*

V. Opportunities For Enterprise

One of the objectives of this seminar was to assess the business opportunities that might relate to a future conserver society. I will suggest only a few that somewhat obviously follow from my remarks and projections thus far.

Even when allowing for the possibility of over-estimation in future food output and resource input, the production, processing, distribution and marketing of food will certainly continue to grow on most fronts and provide business and industry with much opportunity and challenge. One sobering thought in all this, however, is that most of the increase in food production between now and the year 2000 may have to find an export market. A McGill University study has analyzed Canada's 1972 consumption levels of eleven food categories and determined that on the basis of a 30.7 million population in the year 2000,consuming a recommended diet, there would be no need for any increase in production for

* Some Ecological Aspects of Canadian Agriculture, by Ecoplons Limited, Waterloo, Ont. July, 1975.

nine of the eleven food groups; only fruit and vegetable production would need to be expanded. However, if Canadians continue to eat at present levels (as opposed to recommended levels), production would need to increase in five of the eleven categories.

Perhaps the greatest opportunities that a conserver society has to offer enterprising minds and dollars will be in the areas of education, research and development. Education at all levels in the system will have to communicate, with a measure of urgency, many of the new realities and the new responses that are called for, but research and development may have the greatest challenge. Energy sources alternative to fossil fuels will need to be developed. Old equipment will have to be adapted or new equipment designed to new energy types. The vast energy potential of bio-mass surely justifies, even today, much more R & D attention than it currently receives. Energy conserving farm equipment, such as zero or minimum tillage machinery, may warrant further R & D as will farm building design and materials. The list could go on and on. Should one extend the discussion to the processing and distribution sectors of the food chain, which this paper has not attempted, then in the light of energy, water and other resource constraints, the need and opportunity for commercially oriented research and development are nigh unlimited.

The limitations of time for both the preparation and delivery of this paper have allowed for only a superficial highlighting of some gross food production possibilities in the future, followed by a brief reflection on some adjustments in our agriculture that may result from recent

economic and environmental shock waves that are making their mark on our collective mind.

Throughout the preparation of this paper I was in complete agreement with the Chinese proverb that says: "It is very difficult to forecast - especially with respect to the future".

ACKNOWLEDGEMENT

I wish to acknowledge the primary information sources that provided the background from which I gained insights and obtained material that was incorporated into the text.

1. Dr. W. S. Ferguson, Research Co-ordinator (Soil Fertility) of Agriculture Canada, Ottawa, kindly made available some of his latest tables and calculations respecting Canada's land resource and its potential productivity. This was much appreciated.

2. The Agrologist, Volume 6, No. 1, Winter, 1977, published by the Agricultural Institute of Canada, Ottawa, and the many contributors to the 1985 food production and resource use projections.

3. Food Production in the Canadian Environment: Perceptions 3: Study on Population, Technology and Resources: by Barbara J. Geno and Larry M. Geno: December, 1976.

4. Some Ecological Aspects of Canadian Agriculture, prepared for the Committee on Population and Technology - Science Council of Canada, by Ecoplans Limited, Waterloo, Ontario, July, 1975.

5. Agriculture, Food and Renewable Resources in a Conserver Society. Conserver Society Project Study No. 3., by Benno P. Warkentin, Professor, Department of Soil Sciences, Macdonald College, McGill University.

Discussion

Leon Katz - Director
Science Policy Secretariat
Government of Saskatchewan

Professor Siemens, I am not a farmer. However, having lived in Saskatchewan for 31 years I have learned a little about farming. For instance, some years ago I attempted to calculate or measure the impact of technology on agriculture. I drew a graph of the man hours and man minutes it takes to harvest one acre of wheat including threshing over the past 120 years. It took 3,300 man minutes or 55 man hours - essentially one week of today's work- to harvest and thresh one acre using a cycle and flial 120 years ago. As I plotted the curve, I noticed that as the technology advanced it was decreasing essentially in a logrithmatic way until today it takes 10 man minutes. Now the impact of that advancement in technology - especially given the cost of labour, its general unavailability and the continued low cost of energy (until OPEC raised the prices) has been enormous. Our farm sizes continue to increase to allow for economies of scale and to use larger and larger machines. As a result, today one man can harvest essentially a section and a half or about a thousand acres of crop.

I have three questions arising out of this for you. I think Western Agriculture is much more energy intensive than Eastern Agriculture or the Maritimes. The figures you gave were approximately 30% for machinery direct and operating costs, chemicals 2% and fertilizer 7% to a total of 39%. I assume these figures were averages for Canada; what would these figures be fore the West approximately? The second

question is, what is the elasticity between the minimum price a farmer can charge for his crop and the price of energy for the farm in order for the farmer to be able to survive? Thirdly, zero tillage does conserve energy and machinery but I understand that it also takes a considerable amount of extra nitrogen to get the same production if you plant on stubble. I wonder if you have any answers to these questions?

Leonard Siemens

Those are good questions, but I am afraid that I really do not have the figures to answer them. As I mentioned earlier I did not find all the answers that I would have liked to have found in the reading I did for this paper. I wonder if I could have some help from the audience; is there anyone who would like to express some views and opinions on these questions? I have more appreciation now for the former speakers who got questions leveled at them - kind of machine-gun like - three, four and five at a time. Could you repeat the first one again?

Leon Katz

The energy intensive component, nationally, is 39%. What is it in the West?

Leonard Siemens

Terry Oatway, did you get that question? Terry is my energy consultant today. He is an agricultural engineer and I believe he has

done some work in this area.

Terry Oatway - Director Technical Services
Department of Agriculture
Province of Manitoba

I do not know the figures as they break down between the East and West off hand.

Leonard Siemens

These are all the figures I have here. I am sorry. Had we, at the University of Manitoba been involved in all this background work ourselves,we would have the basic data from which these statistics were acquired.

Leon Katz

How much extra nitrogen is needed on zero tillage soil?

Leonard Siemens

Dean Shebeski, do you want to comment on that? I am very glad he is here; I told him I would need him and I surely do.

Len Shebeski - Dean
Faculty of Agriculture
University of Manitoba

I would like to respond to the first question and then come to the second one. With respect to the energy costs east versus west, I think the figures were derived from the total amount of fuel consumption in all of

Canada. Although, it should be easy enough to get data on all the tractors used in the East and West, I do not have the break-down right now. However, I am not so sure that the energy requirements in the West are that much greater than in the East. I think you will find that the consumption will average fairly well because the regions have a different farming system.

Coming to the question on the use of nitrogen, you will require the same amount of nitrogen essentially regardless of whether or not you use zero tillage. The crop requires a certain amount of nitrogen for sustained growth, (there is a soil analysis done to learn this) and zero tillage does not change the nitrogen requirements over the conventional types of tillage on stubble crops. The value of the zero tillage is that you have better moisture conservation, less danger of soil erosion and fewer operations per year. However, you will require a different type of equipment and probably a little more power for that one operation in the spring; harvesting will be the same.

Avrum Regenstreif - Planning Secretariat of Cabinet
Government of Manitoba

I have two really inter-related questions. First of all, in your numbers you indicated a population decrease of approximately a hundred and twenty thousand in the Agriculture Sector during the period from 1975 to 1985. I would like to ask the question: "are agricultural planners now perpetuating a certain myth by using straight line projections of population declines in agriculture?" The second question which I think relates to the first one: "where are the farmers going to get cheap or low priced

energy to enable them to increase their energy consumption by 80% from 1975 to 1985 especially if the so-called trend of reducing the human activity in agriculture continues and the farmers move supposedly to more capital intensive agriculture.

Leonard Siemens

I think I raised both of these points in my own discussion, indicating that perhaps new economies of scale might evolve with changes in one of the major inputs into the system. Economies of scale could conceivably be captured at a somewhat smaller scale and if energy costs become almost prohibitive as they might indeed according to some forecasters - there could be a gradual increase in the total proportion of labour on farms. Now this is speculative and requires much further study.

I do not think there is any particular myth being perpetuated. The data of the past speak for themselves as to what has in fact happened and it has happened up to this very year and there is not anything that significant that has happened to suggest that the trend will suddenly stop.

Lynn Batten - Consumers Association of Canada
and the University of Winnipeg

The paper has really considered only the quantity of food produced and has not looked too closely at the quality.

Professor Siemens did mention occasionally that a steady increase

in chemical use on farms was expected and intensive future research will continue. I am wondering which government agencies or groups are responsible or would be responsible for determining what chemicals are safe to use? Where would the individuals find out what standards these agencies are using? Where does one find out what chemicals are being used on the food that we are consuming in say, Winnipeg or Manitoba? What chemicals are being used on privately owned land? Finally, if an individual objects to the use of some of these chemicals how does he go about making these objections known?

Leonard Siemens

I believe there is an agency in the Department of Agriculture and also a related one in the Department of Health and Welfare areas in Ottawa that legislate which chemicals can be used in agriculture and under what conditions they can be used. This legislation is printed on the outside container labels of all chemicals. Some chemicals are prohibited for some kinds of uses and permitted for other kinds of use. It is a very, very complex body of legislation and the decisions are often made on the basis of residues these chemicals leave on certain kinds of crops. These residues have been measured, monitered, analysed and then judgements are made about their environmental and human safety (or risk). I think we have indications from the kinds of decisions people are making recently with respect to the use of saccharin that they are inclined to tolerate the great measure of risk. Nevertheless, at least in the opinion of agriculturists the rule is 'if in doubt rule it out' is very much the

guideline that should be employed in setting these regulations of chemical use. Even though they are very, very carefully monitored, there can be the abuse in the use of a chemical, that is possible. However, the Manitoba Department of Agriculture through all of its agencies and chemical companies, themselves, and everyone in the industry is very much concerned about education - education in chemical use. This is about where it is at - careful use under legislative control.

Joe Campbell - Professor of Horticulture
University of Manitoba

I would just like to enlarge a little bit on a couple of points that have to do with the trends of consumption. I believe that there are basic errors, several basic errors in our present diet. I have to go along with our CAC person here to some extent. People are becoming more concerned - and they should be - about the diet that we are now following in Canada. For example, the consumption of highly processed refined carbohydrates is, I think, detrimental to our health. It is too low in fibre, too low in nutrients and too high in calories. A reduction in the consumption of this kind of food would be beneficial and it would use less energy which, I think is what this conference is all about.

A second point has to do with the meat consumption. I have noticed, Len, that in your figures you show that we are going to increase the consumption by 15%. I think this would be a tragedy. We have already increased our beef consumption by 100% in 15 years. We are eating now 2 to 3 times more meat than we need and we know that the production of meat is highly energy

intensive. Now why do I say that? Primarily we are eating more than we need and it is costing us; that is point one which is economics. Point number two is the ratio of phosphorus to calcium in red meat is 16 to 1, whereas the optimum ratio of calcium to phosphorus in human diet should be 1 to 1. Thus, we are tninning off our calcium balance and this is resulting in a lot of back problems, arthritis and many other things in Canada. Now I would say that by reducing our meat consumption we could greatly reduce the cost of food in Canada, and this would be beneficial. Now naturally, and I will show my bias here, I really think that what we should concentrate on growing and consuming is fruit and vegetables. We have hardly scratched the surface in terms of what we can do in Canada. We can use protected growing devices such as greenhouses. The average person will not only produce healthier food but he will use muscle power instead of hydrocarbons.

Leonard Siemens

Joe, you will be happy to know that the McGill University nutritional study, which I referred to earlier, indicated that even with a population of 30 million or so in Canada and that even if we apply the officially recommended nutritional guide to all people in Canada - we would not need to increase meat production to meet the forecasted demand in the year 2000. However, we would need to increase fruit and vegetable production.

5.

LUNCHEON ADDRESS

By Premier E. S. Schreyer

Ladies and Gentlemen, I want to thank Dean Shebeski for that most unusual introduction. I think it goes to explain why he is a man of science and not a man of politics. He is just too blunt for politics.

I understand that this week is "Hearing Awareness" week and I think it is rather symbolically appropriate that it juxtaposes with this conference which is also very well timed. There has been for sometime now, growing discussion in science circles and theoretical circles about where society is going or drifting with respect to future energy prospects. However, not until recently, and very recently at that, have I gotten the impression that anyone else was listening. I think that now there is by outward growing concentric circles an increasing awareness and a much greater willingness to listen than was the case even a few short years ago.

The theme of this conference symposium is "Business Opportunities in a Conserver Society". I can think of nothing more relevent at this stage in history and I want to thank all of you for taking the interest and the trouble to be here. I want to thank those who organized the discussion, those who have come from outside the province to participate and all of you from the local area.

I think that we have in many ways not only great challenges but great opportunities in helping to evolve towards a more responsible relationship between industry, industrial life style, and future energy methods and habits of use. There is, unfortunately, the often made assumption that as we go

perforce more and more into the practice of energy conservation that this will somehow have a stagnating effect on our economy. Yet, I dare say, that the more you think about it the more it seems plausible that growth (sustained rational growth), business opportunities, and future development and evolution of technology are all quite compatible with a pervasive conservation ethic. I do not pretend to perceive by what degree these changes will occur but certainly there is, I would suggest, no basis for assuming that energy conservation somehow leads necessarily to stagnation.

In recent days we have heard the President of the largest industrial producing country in the world come forward to the public with some very specific and concrete proposals. Maybe they are not all that specific in every detail, but certainly in outline, they are quite specific as to what the perceptions are of those who are in positions of decision-making relative to future energy supply and to energy supply duration curves on prices. It remains to be seen whether or not there will be a wide spread acceptance by the citizens of that country of the rather dramatic change in direction with respect to attitudes and systems of use of energy. The ground work has been well laid and, of course, they have what I believe to be, as obviously they believe to be, the facts as to future energy supply and implications. In the last year or two it would seem that there is a remarkable consensus building up at least on the point of estimates of future duration of the supply of fossil fuels and in particular the supply of liquid hydro-carbons. People as diverse in outlook - as different in opinion as to what should be done from this point on - as Bob Hart or someone such as Amory Lovins (who has written an article which apparently has excited many people) tend to agree on the

diagnosis as to the future duration of availability of fossil fuel and liquid hydro-carbons. What should be done as a consequence is where the argument, I am sure, will warm up.

In the meantime, I am wondering if it cannot be generally accepted, whether we disagree by ten or twenty years in the estimates with respect to projections of future fossil energy prospects, (that is in the most fundamental sense besides the point) that there should be a willingness to gear up now so that within the time frame we are talking about, it will be possible to put the alternatives into place on an operative scale sufficient to take up the slack left behind by the gradual disappearance of available fossil fuels. There seems to be a determination to get into a polemic by those who want to believe very badly that all of the future replacement of fossil fuel can take place on the basis of a totally income type of energy as opposed to capital energy even though they have insufficient evidence to date - they have some evidence presumably. They have begun to write articles some of which are,shall we say, learned articles that are so enthusiastic - they are almost poetic - about the possibility of bio-gasification, solar energy and wood-gasification and so on and so forth. Now I am not saying that there is not an important, indeed almost critical, need to be willing to commit both brains and money towards the development of these on a scale and on a basis that is sophisticated enough to become pervasively useful. One accepts that. However, I am wondering if we would want to be so optimistic about those projects that we are willing to gamble solely on them. Therefore, there is need to acknowledge the responsible requirement,

at least for a time, (bridging time of who knows how long - decades certainly) of continued development and refinement of nuclear energy and that recognition in combination with these other possibilities is what really holds out the most realistic options for mankind. So far, however, I think we have managed only to generate enthusiasium (which is good) for these co-called alternatives of a renewable type coupled with the idea of the need for a pervasive acceptance of a conservation ethic.

Here in Manitoba we have begun, in a modest way - but we have begun nevertheless - the process of getting certain changes into place in a context, I would like to think, that is entirely compatible with national efforts and national attitudes. We have for the last four years been operating a program which started out as a pensioners' home repair program but after twelve months has been expanded to be called "The Critical Home Improvement and Repair Program". Under this program a person can obtain a combination of, I believe up to a thousand dollars in a grant and a thousand dollars in a loan to be used primarily for the improvement of homes with respect to insulation, weather stripping and the repair of windows, doors, sashes and the like. We have followed that program up by removing the sales tax on insulation and related building material. In addition we have brought in something that I think is very much a matter of common sense yet I am not sure it is in place anywhere else. Through the instrumentality of the utilities, (we could have presumably done so through the local municipal office, but it is administratively more manageable through the utilities) we have provided for long-term loans

at crown lending rates so that people can, by means of a repayment of $9.00 a month approximately over 15 to 20 years, obtain funds for not only insulation but whatever else is needed to make homes more energy tight. This program which is perfectly consistent with the conservation ethic goes into operation in a matter of weeks. I rather suspect that this is a very common sense mechanism for where ever there are utilities, which is to say almost every where in North America and in the industrial world. We are getting a pervasively available program to people which - the actual family or household budget implications are quite manageable, $9.00 a month over a period of several years - makes it possible to do a $1,000.00 or $2,000.00 dollars worth of work of an energy conserving nature now. In addition, last year we made changes with respect to motor vehicle registration so that, as President Carter has indicated, "gas guzzlers" - that is his term - pay more and those that are less energy consuming will enjoy either a frozen level of registration and license costs or even some rebate. I guess in a way I have to admit that this change in policy is relatively modest; we are not talking of several hundreds of dollars but I think that the limit does extend to as much as a hundred and fifty dollars surcharge for the heavier, more energy consuming automobiles. Then too, we have been wanting to encourage people to think in terms of the installation - although it is so highly incipient, it is almost embarrassing to mention - of ingenious means of trying to capture solar energy in homes. We have found that at present there is a grand total of three such installations in Winnipeg and that immediately

after installation the people concerned were faced with a sharp increase in their real property assessment. So we have indicated a means of re-imbursing municipalities for simply not levying taxes on the incremental assessed value of homes by virtue of a solar energy installation.

All these are very mundane examples but they do point to one fact and that is that the first step, the first faltering step towards what has to be a series of major steps, expecially in the free industrial world where we have become so horrendously over-dependent on a finite fuel regime, has been taken. As James Schlesinger of the United States Energy Office puts it, the dilemma we face today is a classic case of exponential growth rates of consumption of those very same resources that are finite and fast depleting.

I have now come back full circle to what I am sure is the very substance of what you were talking about this morning and I am sure what you will talk about later this afternoon. However, as a layman, what I find disturbing, is the sharp dichotomy of view amongst those who are assumed (and I mean that genuinely) to be well trained in their discipline of physics, chemistry and in all other related professional skills, as to whether the future will require any kind of substantial interim dependency on nuclear energy. When there are those with impressive credentials who talk in terms of nuclear energy being so unacceptable that it ought not to be countenanced for any expansion at all, even in the interim, then I am sure this is going to cause all kinds of heavy, heavy difficulties with the

general public in the very next decade. That is why, as I have said on previous occasions and I repeat it today, I believe it would be beneficial for all of us if there were an attempt made to have a definitive enquiry commission at the national level. There is a need for specific responses to specific theses of uneasiness. We could then get on with a responsible provisional policy for the future. If I were asked I would have to admit that faced with a choice of being able to put in place nuclear capacity or of avoiding it and thus having to continue our relentless drawn-down without let up even in degree of liquid hydrocarbons, I would have to opt for the former. The latter alternative is becoming only too painfully obvious as a dead-end street that no responsible generation of humanity would want to continue to perpetuate on the next succeeding one. Yet this is the course of action we seem to have been so blithely on for so long.

Now of course none of this can change dramatically in a year or five years or even a decade but it must change within two decades on a significant scale. That is why I do not believe it to be a radical proposal when I say that national authorities - not just in the U.S. but in Canada and certainly in the western European countries, should be willing to somehow allocate a greater proportion of national capacities for a meaningful - I mean really meaningful - scale of R & D into alternative energy. You think back about 10 years or so and you will recall that there were many millions of R & D dollars available in Canada for such things as the Bobcat or the DHC 7 stall or semi-stall aircraft; it was on a scale of a

$100,000,000 and indeed more. There is talk now about the purchase of some delta wing fighter aircraft. I am one who has never been particularly critical of our defence efforts but, as one who has been in the Royal Canadian Armoured Corp, I have to say that I wonder what the practical consequence for Canada would be if we were to buy one or two delta wing fighter aircraft less (we are talking about hundreds of millions of dollars) and instead allocate those funds towards R & D into alternative energy, towards more experiments and pilot size demonstration projects.

I get the impression that there are, in some parts of Canada - in Prince Edward Island to some extent and to some extent in Manitoba for instance - some rather interesting, if small scale projects ready to be tried in the renewable or income energy field. One has to do with the gasification of wood to produce a low grade gas which in turn can be used in a slightly modified diesel engine in a community where we may now be paying 80 or 90 cents or even a dollar per gallon for diesel fuel. We, in Manitoba are going ahead anyway with this project but it would be rather nice if there was real systematic backup and encouragement from the federal people for effort such as that. Maybe I am so much a politician that I cannot help myself but I rather worry about the need to spread the risk about even if we are only talking a few tens of thousands of dollars. Obviously I do not mean just the monetary but the political risk too. There is nothing as embarrasing to the politician as to be intimately involved with a concept or project, to find later that it does not work and to have all the others say "Aha, see he is fooling around with these new fangled gadgets again".

The gasification of wood is a serious proposal which falls under the general heading of "Small is beautiful" or of intermediate or even lower scale technology that may have no meaning whatsoever in southern Canada but it may have great relevance in hard economic terms in certain selected places in the mid-north of Canada. For instance, areas where the replacement of diesel fuel by local potential fuels, however converted or modified, could ironically, have great significance in the social field by generating direct employment opportunities in communities which may be 80 to 90% on chronic welfare. If this type of fuel supply proves feasible, it does not take much imagination to see, that it is supportive of the possibility of having some development of smaller scale businesses in the Metal Fabrication Industry to provide the means, tools, the units which would be needed in this kind of intermediate or lower scale energy technology.

In any event, such a proposal is a concrete example of how it just may be that, in ways hardly yet foreseen very well, the conservation ethic or it in combination with small scale technology may actually have a very stimulating effect on certain kinds of businesses, certain sectors of our economy. But then again, what is new about that? It has been always the case throughout the pages of history (for instance the industrial revolution and its aftermath) that certain kinds of new products or methods would come forward and would prove to be a bonanza for one industry or one sector of industry to the detriment of another. That is why there has to be

resiliance in the marketplace and in industry. I mentioned that one example - it is so small scale that perhaps some may think that I should not even bother to have mentioned it - but it is a concrete example of how at least to some extent, the thinking of those who are so enthused about "Small is beautiful" and low scale technology may have indeed a valid point.

Related to that example is the fact that seven years ago there was growing curiousity among some of those I worked with as to what kind of circumstances, economic and international etc. would have to exist in order for us to get serious, at least serious enough, to do thorough going feasibility studies on the possibility of the use of certain bio-material for either the production of ethanol or methanol by one process or another. There really has not been a willingness to put, to commit a few tens of millions of dollars to a pilot plant for this and I really think that, given the context we are in, there should be that kind of willingness even if it may not have any prospects of making immediate sense. There is need to become more familiar with operations even on some of the less likely possibilities. (I think you should find it somewhat intriguing to learn that people who have been the most useful in answering many of the questions that arose in terms of this little project of wood gasification have been those of 75 or 78 or 80 years of age. They have lived through an industrial technology era when their skills or particular learning were relevant to that type of energy use. These people have lived through, witnessed and indeed became part of the conversion from coal and coal gas, municipal and town gas, to oil and natural gas and now they are still here to witness the beginning of what surely will later be a major

re-conversion to what they were familiar with or some variation thereof. It is in that context that I repeat, for a country our size to have one or two projects of this kind is not good enough; there should be more effort and there should be not only a willingness to co-operate but some stimulus or prodding on the part of the people who have responsibility at the national level.

We have - and frankly I do not know where it is going yet - a very interesting activity underway now. It is a joint three-way feasibility study between Trans-Canada Pipe, Atomic Energy and Manitoba that is trying to evolve a preliminary engineering feasibility study on the costs of putting in place a pilot plant for the electrolysis of water - decomposition of water into hydrogen gas - to see if there is any prospect at all of bringing it in, say roughly at $3.50 per million b.t.u.'s. If it can be done it would put it into the ballpark of comparability with the cost of the synthesis of natural gas from petrochemical sources such as is now taking place in eastern United States at costs, we are told, of $3.50 and indeed more than that per million b.t.u's. But again I do not think that having one such activity is good enough in a country our size, and there should be a willingness to commit much more. I only hope that it will be found possible in terms of national energy policy, to think of allowing fossil fuel prices to rise closer towards international price levels and that some small part of that by way of taxation be used to provide the means not only of encouraging conservation by means of rebates but also of providing some of the needed funds for a more meaningful scale of R & D for alternative energy.

I want to conclude my remarks by saying that, for a layman, it is not only confusing but sometimes painful to see the extent to which we have allowed years to pass without really making even the beginnings of a systematic effort to cope. The major exception to that of course, in the case of Canada, is what has been made available for the development of one of the most sophisticated nuclear energy authorities in the world. In a sense we should be both proud of and relieved at that fact. However, I have a slightly uneasy feeling that in a sense we have put, at least so far, all of our alternative energy research and development eggs into one basket, namely, the nuclear basket; that is the one aspect of all that I do quarrel with. I am hoping to see more tangible signs at the federal level that there will be a greater proportionality injected into the allocation of funds for research and development between nuclear and all other forms of alternative energy potential. One of the writers on this general theme used as a heading for his article a stanza from Robert Frost:

"Two roads diverged in a wood, and
I took the one less travelled by,
And that has made all the difference"

That is great poetry, but the only problem with it is that it implies that we must take only one of the two roads. That is precisely the kind of advice that we should want to resist. There is a need for a balanced and a greater effort as between all of the work that has been done to date in the nuclear field plus these other fields which are only in their infancy,

so to speak. I hope coming out of symposiums like this one and out of all other policy discussion opportunities, will be a greater and more persistent show of support and a persistent request of the federal and provincial decision-makers to be a little more willing to engage in risk and outlay of funds for more meaningful scale research and pilot projects. I thank you.

6.

GOVERNMENT ECONOMIC DEVELOPMENT STRATEGY: THE P.E.I. EXPERIMENT

Mr. Andy Wells
Man and Resource Institute
Prince Edward Island

Ladies and gentlemen, listening to Premier Schreyer at noon talk about being a layman, almost with some apology, in the various areas which we are examining today, reminded me, quite forcefully, that I am as equal as he in being a layman in the field. Yet, I would encourage Premier Schreyer to continue to carry on as a layman because certainly his perception of the problems and his concerns were quite evident. I certainly, personally, have become convinced that one of our problems in this whole area is that there have been too many technical people (too many technologists and scientists) telling us the laymen what should be done. All too often their advice is lacking in the application of - what you often find in laymen approaches to the problems - common sense and this has been to the detriment of some of the approaches that we have ended up taking. Hence, I am going to approach the subject before us not only as a layman but, also, as somewhat of an evangelist. When you get into any new concepts I think it is necessary to have some people talk in evangelical terms and I am going to do so without any apologies.

I got the distinct impression, listening to Dr. Hart this morning, that in some way our continued use and production of energy was sort of an Act of God. If so, it is an Act of God, as the Scots would say, under very suspicious circumstances. To ask a leading member of the nuclear

establishment to outline the sources, availability and costs of future energy is akin to asking the fox to look after the geese. I could very easily take up my total allotted time in rebutting or in criticizing Dr. Hart's remarks but of course, that is not what I am here to do and I would, instead, urge all of you to very carefully weigh the presentation and to seek out as many other sources - and there are a variety of them - which certainly paint a different picture and present a different view, and in many cases have very different figures.

Although the title of my remarks is listed as "Government Economic Development Strategy: The Prince Edward Island Experiment", I would like to be allowed some freedom to expand my comments from the specific to the general; and be permitted to speak on the general theme of the seminar as well.

There are a variety of definitions used to describe the Conserver Society; but I prefer to use an example to illustrate the thinking of adherents of the Conserver Society (or "C.S." as insiders frequently say) as compared to the preception of non-conservers.

We find in this example, the conserver and the non-conserver sitting in their respective bath-tubs, both looking forward to a hot bath. However, the hot water runs out of the tub almost as rapidly as it enters. Our non-conserver considers the situation, applies his slide-rule to the problem and decides what he needs is a bigger hot water heater, a larger storage tank and more electricity. The conserver contemplates his problem, looks around for available indiginous materials and invents the plug.

The action taken by the conserver has been described as using appropriate technology, whereas, the solution adopted by the non-conserver would be termed inappropirate to the circumstances; that is needlessly wasteful of energy, materials and human effort.

Speaking in the grossest of generalities, it can be said that this approach or attitude toward our resources is common to much of Western Society; certainly it can be argued, characteristic of North American Society.

Lewis Mumford, the great American historian-philosopher, has suggested that North American attitudes toward resources have their roots in the way in which the continent was conquered. It was conquered with violence, and in the general belief that endless frontiers stretched out before us. Consequently we viewed development from a rather violent perspective, and considered physical resources to be virtually without limit. Nature has, more often than not, been considered something to conquer, to overcome, to bend to our needs and desires, and not as an intrinisic part of mankind's very existence. I had that view reinforced, I think in some measure, listening to the early statistics on the future of Canadian agriculture. They were somewhat modified, as the principle speaker moved along but I got the distinct feeling that the attitude about nature and that attitude about our continent was still very prevalent. In almost every instance where man has manipulated, or attempted to manipulate natural processes, man's environment, whether social or biological, has been harmed, often irreparably.

Let us for a moment return to our non-conserver and his emptying bathtub. Canadian business, advertising, marketing systems, government, and in most cases individual attitudes have been geared to assist growth, to promote consumption, and to exploit resources to the full with little or no concern for the long term effects. Despite what was said earlier this morning about the utilities not promoting the consumption and use of electricity, I find, certainly in my area of the country, that the blatant promotion has slowed down or has ceased, but there is still a great deal of subtle support and subtle means of promoting the continued and ever expanding use of electricity by the utilities. I had an employee of mine phone the Nova Scotia Power Commission, not too very long ago and ask the individual at the end of the phone what sort of heat he would recommend. The answer came back "electric". If you know the history - the recent history - of Nova Scotia and electric heat, I think you will appreciate the irony of that answer.

It has been argued, and still is argued in many quarters, that these attitudes - that is the non-conserver attitude - about growth and resource use are necessary for the maintenance of the Canadian way of life. The suggestion that we can and should reduce our per capita energy consumption brings forward cries of "a lower standard of living, economic stagnation, high unemployment, reduction of our quality of life" and so on. Suggestions of more careful and conserving use of resources generally will elicit even more dire warnings about a threatened society. Proponents of such views would indeed argue that it is preferable for society to solve the hot water problem by building bigger and better systems for producing hot water.

It is preferable because to do so puts our resources to work, provides employment, and is high technology which, with luck, can be exported to developing countries. Such an approach, of course, ignores the real possibilities and the genuine opportunities in the conserver approach. It ignores, as well, the point that the conserver approach minimizes adverse effects upon the environment. A reference this morning was made to studies being made or having been made on the adverse environmental effects of various energy production systems and it was stated that none were absolutely benign. That may be quite correct but it is rather irrelevant when you look at the degree of benignness or lack of benignness in some of the approaches we are entertaining.

To some, a bathtub plug is not nearly as exciting or as lucrative as a nuclear power plant. Yet reduced to its most simplified form, this contrast in attitudes is the crux of the issue.

David Cass-Beggs, former Chairman of the B.C.Hydro Commission once wrote:

> "In working to achieve a society in which the demand for energy (and here I believe we can substitute resources for energy) will be limited, we are looking towards a radically different society . . . and the change will be so significant that it will constitute a social revolution. Will human life be dull when we are operating at the top or flat part of the curve, when the only way in which we can have more work done is to use the power (resources) we have available more efficiently, or more intelligently?

Life could be much more interesting. Some of the joy of life will lie in getting more out of life without using more power (resources), in using existing power (resources) to better purpose, in developing power-less (resource-less) activity, social and community activities based on human co-operation rather than competition. Perhaps man will only really begin to live when he has reached the limit of his power (resources)."

I am not sure whether or not these kinds of public statements or public writings has anything to do with his departure from the B.C.Hydro Commission.

Dr. Hazel Henderson, co-director of the Princeton Centre for Alternative Futures, in recent testimony before the Joint Economic Committee, 94th Congress of the United States, pointed out the urgent requirements to reassess our current concepts of economics, productivity and resource use. Quoting from Dr. Henderson:

" ....two new sources of inflation are now best understood from beyond the disciplinary view of economics.

The first arises from the unmodelable, unmanageable levels of complexity of our society and the soaring unanticipated social cost it is now generating (which are still added to the G.N.P. as if they were real production)....

The second source of inflation is rooted in our declining resource base and the worsening population/resource ratio on the planet. We must now cycle ever more capital back into the process of extracting energy and raw materials from ever more degraded and inaccessible resource deposits, with ever declining net yields. The theory of continual (resource) substitution is over-optimistic and does not deal with simultaneous rates of depletion across a whole range of resources, thus reducing substitution options. This type of declining productivity is beginning to manifest itself as a "capital shortage" and exerts a multiplier effect through the economy."

and later

"....Today's choices are no longer the simple choices of yesteryear. They involve higher technological stakes and graver human risks than ever before. These meta-level trade-offs involve not simple choices between energy options of autos and mass transit, or from the usual menu of public and private goods and services. These meta-level trade-offs involve choices between social specialization and division of labour versus its social and transaction costs; between centralization and decentralization of production and population; between capital and energy-intensity versus labour-intensity with a much more complex reckoning of externalities and social impacts.

Since rationality now dictates that we conserve our scarce and costly capital and natural resources, we must now fully utilize our human resources. We must run our economy on a leaner mixture of capital and richer mixture of labour."

I have perhaps belaboured these points. However, I feel it is absolutely essential to understand the nature of the changes contemplated when discussing the conserver society. It is not simply a case of business as usual with some of the traditional markets and consumers just slightly adjusted. It is more than business and businessmen producing a new product line and then getting out and selling. What we are talking about is much more profound, much more significant. It is, to use Cass-Beggs' words, "a social revolution, a radically different society".

To my mind, it is no longer an open question as to what our attitude, should, indeed must be. If we hope to survive physically and continue to grow (intellectually and culturally) as a nation, we have few options open to us. Our task now is to firmly grasp the opportunities and possibilities inherent in those options; opportunities to create an exciting and productive society based not upon ever increasing resource exploitation, but rather upon an understanding of the natural limitations and a full but careful use of indigenous and renewable resources all around us.

This does indeed suggest a quite different society than that in which we presently exist; a society which can be more productive, less aggressive, gentle rather than exploitive, and more humble; a society which can take

advantage of the opportunity offered by a diversity of approaches to improve our overall economy, and in the process provide stability and flexibility within that economy. In the words of John Todd "an elegant society".

Now to be more specific. Tentative studies and examinations have been made of the implications to business opportunity in a conserver society. Much more remains to be done before a clear picture will unfold. In addition, actual experience will soon begin to catch up with theoretical studies so that a seminar such as this will, in a few years, be hearing from those who have real experience in the field. You have heard from Dr. Josef Kates, Chairman of the Science Council of Canada, the organization which has given a great deal of time to an examination of the Conserver Society, and in particular its impact upon traditional economic and social structures.

Having no wish to duplicate what Dr. Kates has said and what Dr. Smith may say when speaking to you later this afternoon, I will simply repeat a few observations gleaned from studies already conducted.

The claim that renewable energy sources are pie-in-the-sky does far more serious damage than simply clouding the issue; it discourages Canadians from innovating and casting about for opportunities to fill a real national need for the technologies and systems which will eventually permit us to enjoy stability and balance of energy supply.[1]

1. Conserver Society Notes, Fall, 1976. P.6

For example, one estimate suggests that if 10% of new homes are equipped with solar heat in 1978, and this is increased to 70% by 1990, a total of 40% of all new housing from 1978 to 1990 will be solar heated. Total sales revenues for the solar collector industry over the period would be between 5 and 6 billion dollars. Total revenues, including not only the collectors but also all the accessory equipment, such as plumbing, control systems, storage tanks, installations and so forth, would range around 11 billion dollars. Comparisons with productivity in the heating, ventilation and air conditioning sector suggest that 100,000 man-years of work would be created in that period of time.

Despite these impressive figures, Canadians, as the Conserver Society Notes observe, while complacently consuming our last few decades of non-renewables, will find foreign-based multi-nationals sending around their salesmen to sell us over-engineered versions of technology we could have brought on stream ourselves.

In 1976 the Prince Edward Island Legislature held four days of sessions to consider energy futures. One of the principale speakers was Mr. George MacRobie of the London Intermediate Technology Development Group. I can do no better than repeat a portion of his testimony to the P.E.I. Legislature. I will quote from him at some length because I think he had a very important message not only for Prince Edward Island but also I think for Manitoba which has somewhat - and Premier Schreyer made passing reference to this - similar basic interests that P.E.I. has for this kind of approach and philosophy.

"Until the last few years, there was a widespread assumption that technology could only move in one direction, that was up, bigger, more expensive, more complex. Now this assumption that technology can only become bigger, more complex, more expensive, was largely unspoken, and it was enshrined, if that is the word, in an ideology of economic growth that has been with us until very recently. That is, that growth of particularly rapacious kind, would be with us forever. No one ever said when does the growth level off. That ideology was still with us when we formed the group in 1965 (we being the technology group that MacRobie belongs to). For the rich countries in the world the argument was the sky is the limit and for the poor countries the argument was become as like the rich countries as soon as possible and you, too, will become rich.

It was the great virtue of Schumacher(that is Fritz Schumacher who, as most of you will know, wrote Small is Beautiful and who is a close associate of MacRobie) challenged this idea. In fact, he did this in India in 1963, when he put forward the concept of an intermediate technology, which he defined, and I think we could still define quite simply, as a technology that lies somewhere between the sickle and the combine harvester, in terms of cost and sophistication and complexity. The sickle has reached its limits, the limits of its productivity. You could not do much more with a sickle. The combine harvester, if that alone was offered to the developing countries, was a prescription for their continuing underdevelopment because it was in reach of only a very small section of the population. If it did, indeed, generate more income, that income did not, as people would hope, percolate downstairs. It remained where it was.

The basis of Schumacher's approach was, and still is, that it is important to look at the cost per work place when looking at new technologies. Over most of Europe, the cost of creating one new work place in the manufacturing industry is now in the order of 4,000 pounds, excluding the cost of land and buildings. That is, equipment cost alone is 4,000 pounds. In most developing countries, the cost of creating one work place, if it was to be 4,000 pounds, would assuredly mean that very few new work place would be created.

From about 1965 onwards, we have concentrated, along with a growing number of other people, in trying to identify technologies which would lie somewhere between the one pound technology of the sickle, and the much more expensive 4,000 pound technology of the combine harvester. In fact, it was about then that we started looking very hard at large scale technology, in its application, not only in the poor countries, but especially in the poor countries, because it was there that the effect of large scale technology was most evident. First of all, it is essentially a centralizing technology. It centralizes activities in large centers. Of course, it was assisted in this by energy that was virtually given away until 1973, it was so cheap."

I would like to just make a quick aside here. If I had to sum up my one major objection about nuclear technology, it is that it is beyond question, a centralizing technology. It can have nothing but adverse effects both social and economic upon the outlying areas of this country, such as Prince Edward Island. Now back to George MacRobie:

"Assisted by cheap energy, the technology we have developed has become essentially a centralizing technology, requiring large scale units of capital, mass markets and, then with that, the whole structure of the economy is determined. The minute you have a

technology of that size imposed the rest of the economy has to take its shape from that technology. It is now quite evident that the choice of technology is perhaps the most critical choice that any country can make. This is not only true for a developing country although it is most evident in developing countries, because on that choice depends who works and who does not and where work can be done. Will it be done only in the city or will it be done in the rural areas? What kind of work is it, (and work is the greatest former of people). It also determines what infra-structure you have. If the type of technology demands that you are centralized in one city, then the infra-structure will follow suit. It can even effect the type of social services you have. There are very few institutional decisions that are made in a country that are not influenced by the sort of technology that is adopted. Yet, surprisingly enough, until quite recently, we have thought of technology of all things as being neutral. It is very far from neutral. It carries its own culture, for lack of a better word, with it and there can be no doubt about that. Many, many cases can be given.

The nature of the technology that we have developed under the influence of the application of science to engineering and virtually free energy - at least, very cheap energy has been very large, very complex, and very capital intensive or, to put it in a more familiar way, towards more labour saving. It would make a very interesting study to analyze why we have always thought in terms of labour saving techniques but certainly in future we must begin thinking in terms of capital saving. One of the reasons is that capital equals energy. The technology we have developed requires vast quantities of energy to manufacture the technology, as well as to run it. So what I am saying, in a rather broad way can be pictured in terms of energy.

Now in contrast with this capital intensive technology what is required by developing countries is a technology that is relatively small, that can fit into small markets and small communities. It should meet the human need which is more and more expressed nowadays in the form of strikes and other forms of action that can only be explained by the

fact that people are sick of working for large organizations. It should meet the human need for smallness, the need for dealing with people and not being dealt with by machines. It should be relatively simple so that you do not have a small core of highly elite specialists who make and maintain machinery but rather so that you can spread the use of such machinery much more widely throughout society.

Technology should be capital saving instead of labour saving and this implies as well, that it would use, very largely, local resources to meet local needs. What is especially interesting is that for the first time in a 150 years what we are really saying to the scientists and engineers is stop devising machines that are labour saving and start devising machines that are capital saving. If anything it is a more challenging task for technologists because it is not difficult to save labour if your capital is limitless. It does not matter how much it costs as long as it saves labour, that is the current attitude. Instead of that, if we should say we will start saving resources; this then would require a more ingenious approach on the part of engineers and scientists than we have ever witnessed in the past.

Our group addressed ourselves to some of the technologies relating to rural development because, especially in poor countries, the problems reside not in the cities where unemployed people tend to make their appearance but in the rural areas from which they are forced by lack of employment opportunities to the urban areas. We started looking at such things as agricultural equipment, water supply, buildings, building materials, small scale energy sources, power supply, services (such as rural help and transportation), forestry and forest products,chemistry, chemical engineering, and a range of small scale industries. Over the past ten years, we have found that the application of modern technology to many of these areas of activity can produce highly efficient but very small scale technology. If you give a subject really serious attention, you can find ways of making it small and efficient.

To cite some examples, let us look at some simple building materials. The most obvious example is bricks. The modern brick works can produce in the order of something like two million bricks a week. We have shown it is possible to operate a brick-works making ten thousand bricks a week at the same unit costs. If it were possible to provide some of the required power by means of windfall or methane the small scale plant would be even more attractive. Cement is another interesting case. A modern cement plant operates at around twelve hundred tons a day. It is possible to make plants which will produce around a hundred and fifty tons a day at a lower unit cost because as you redesign the plant to make it smaller you have to use a different technology. In the field of building it is also not only a matter of scaling down large scale technology; you can by-pass the large scale. For example, work we have done in India has shown that you can produce a very satisfactory cement alternative or mortar (one must not call it cement because the cement manufacturers get angry about that). It is made of lime, brick dust and gypsum and one or two easily available chemicals. It can put up buildings up to two storeys in height at a very small fraction of the cost required if you use conventional cement. (And now a days I would ask who wants buildings much more than two storeys high?)

It is when we turn to forestry and forest products that I think we find the most interesting potential productive developments. Not long ago the head of I.C.R. research wrote an article on chemistry in Britain which said the future chemical plant in the U.K. will be relatively small, will be widely dispersed in different parts of the country and will be based largely on wood. He went on to say that the chemistry of wood has been pretty well ignored for the past fifty years. In fact, the whole chemistry of cellulose has been largely ignored. In the field of small industries, we have a growing body of experience which suggests for example that the most modern foundry will cost 20 to 50 thousand pounds and be highly automated but you can also get one for two thousand pounds. Not long ago, we asked the foundry

industry in Britain to help us develop the smallest foundry that man could devise. They hunted around for a bit and did quite a lot of work on their own. They finally came in triumph to us with a foundry costing less than a hundred pounds; they informed me that I could build such a foundry in my own back yard. It also has the advantage that it could use not only coal or coke but also charcoal as a fuel whereas the larger foundries cannot.

One often finds that scaling down the technology - in fact totally re-designing for new technoloty - tends to reduce the requirements for specialized raw materials or fuels. In my cement case the fuel is oil or coal. The cement substitute can be made with oil, coal, coke, or wood whereas cement cannot be made with wood as a fuel. Cement requires very high temperatures (up to 15,000 degrees) that you can only get from oil or coal".

Well I will not go on although he cites many more examples. He talks, for example, about an industry in Kenya where they began producing egg cartons. They were told it was impossible for them to do so because they would have to put out a million a day to justify the capital costs. They then got their own people to design a plant that put out a thousand cartons a day. Now they have the big industry people running after them trying to acquire the patents on this new technology. The point MacRobie constantly makes is that such things are possible if the problems are properly examined and as he says in his testimony, "don't take no for an answer". When scientists or technologists or industrialists tell you it is impossible he says more often than not that such is not the case; it is possible.

In his testimony he also talks about the colonies. He suggested and I certainly could not disagree with him that in many respects the Maritimes Provinces are colonies to central Canada and I gather from what I read that some western provinces feel that they are somewhat in the same ship as we are. If you define a colony as an area where the main economic and social decisions affecting that area are not made in that area but outside it and secondly define it by adding that the colony is an area which produces what they do not consume and consumes what they do not produce, then basically, you have his definition of a colony. MacRobie argues that basically the need in all such areas is to maximize the self-sufficiency of the locality. This runs against a great deal of orthodox economic teaching - is much the worse for orthodox economic teaching. In reality this idea of large scale international division of labour is a guarantee of impoverishment to very large areas of the world's surface. In all these areas we would argue one requires a new look at technology and a desire to devise a technology that is appropriate to the social and economic conditions. Generally speaking it will have to have the characteristics I have mentioned. It will be smaller, it will be less complex and it certainly will be cheaper in terms of capital costs.

I will attempt to speak briefly to what I was actually billed to speak about. It is Government Economic Development Strategy: The P.E.I. Experiment. Actually we have had a number of development strategies and experiments in my province in the past several decades. The common finding in virtually all cases has been that what has worked elsewhere is not necessarily going to work in Prince Edward Island. Certainly the

major lesson I have learned in observing and to some degree in participating in economic development strategies over the past ten years is that economic and social attitudes, and values cannot be imposed upon a developed culture without creating serious dislocations within that culture and of course real chance of failure from the development strategy.

It is for these reasons that some of us look with genuine hope upon the emerging Conserver Society. Here is a real opportunity to bring some sanity into the Canadian industrial scene; an opportunity to balance the present regional imbalance in manufacturing and processing; a chance to de-centralize current industrial activity and a challenge to return such activity to a manageable scale with employees having the opportunity to become meaningfully involved in their work. Perhaps more than anything else, the Conserver Society concept will allow a province or a region to more fully develop and utilize native, natural and renewable resources to the fullest degree possible. One example from P.E.I. will best explain.

P.E.I. is presently 100% dependent on fossil fuels in the form of oil for the production of electricity. We import these fuels from Venezuela at an annual cost of over 10 million dollars. With the exception of some jobs at Halifax or the St. John refineries, this is P.E.I. cash which leaves the country with very limited social and economic benefit. In addition our present electricity generators operate at about 22% efficiency; in other words 78% of the fossil fuels burned are a direct loss in the form of wasted heat.

We are now hopefully entering a new era. Basing our approach on the concept of the Conserver Society and using appropriate technology which is geared to our people and resources, we have a significant opportunity to turn what has been a disaster into a useful economic, social and environmental approach. Prince Edward Island's land mass is presently about 50% forested. Outside of a very limited pulp market, local saw log operations and some fuel utilization, the majority of the forested land is unused. For many decades our forest land has been high graded to the point where there is now very little merchantable timber and our genetic stock has been severely degraded. The province has invested in a modern tree nursery program concentrating on elite seed and superior or super trees. However, until now the forestry branch has had a problem in reforestation programs because there is so little wood cut that they have no area to plant.

What we are in the process of examining is the social and economic value of developing a wood burning program to provide us with energy. I used the term energy with purpose, for we are thinking of more than wood burning generators to provide us with electricity. We see the distinct possibility of an integrated energy plant to not only provide electricity, but also opportunity for waste heat applications in green housing (for the production of fresh vegetables year round), application in aquaculture (for the rearing of fish stock to seed out as well as direct marketing), application in space heating (schools, hospitals and some houses), for application in small industrial operations (grain drying, manufacturing and processing plants), for application in tree culture, and many, many other possibilities.

Under such an arrangement, we would not only provide needed electricity but we would also provide new employment opportunities in a variety of fields, put our forest resources to work, provide employment in the woods and in addition have the opportunity to replant, over a period of time, our forest land to superior species which eventually (20-30 years) would create a whole new, industrial and business opportunity (lumber, furniture manufacturing, plywoods, and so on).

Such an approach, almost by definition, requires that the energy plants be small in scale, located throughout the Province and geared to take advantage of local conditions and opportunities. This then would have a strengthening effect upon our small communities and help to stop the rural-urban drift so many are concerned about. This concept does require an adjustment of traditional economic thought and a commitment to long term social and economic goals of development. However, social and economic development aimed at full utilization of local resources (human and physical) with a gradual shift from our current dependence upon imported energy, materials and technology.

I have given you but one example of many that are possible for Prince Edward Island. Your situation will be different but the principle should remain the same.

It is these concepts which make the Conserver Society an exciting and invigorating vision. Our forefathers were pioneers and found life to be full. We need to be pioneers of the 20th Century and rediscover the rich possibilities which lie before us.

Discussion

Mr. Remis

You know Andy, one thing that I cannot get over and it is: can small scale industry really compete? You are putting up handicraft against the machine and it seems to me that this is a mis-match that you can not possibly win. Am I looking at it the wrong way?

Mr. Wells

I think that is a traditional point of view and it was probably reasonably accurate say five or ten years ago. However, as energy costs continue to rise - not only in a sense of production energy but also energy in the form of labour that goes into the manufacturing of machines, equipment and so on - we are beginning to see the things balance out. Certainly in MacRobie's testimony it was clearly pointed out that in developing countries, it has been found that small operations could be competitive on a cost per unit basis with larger operations. Admittedly labour is less costly than it would be here but nevertheless I think that we are going to see some similar type adjustments here. In fact, we are going to have to see some adjustments here. I suppose what I have been trying to say in answer to your question is that here in Canada we have not really tried as of yet and until we start trying, start looking at the various possibilities we are never going to be sure of a lot of things. We need, as Premier Schreyer suggests, to do experiments in little pilot plant demonstrations in order to put some of these theories and comments into practice in this country. We are not doing these things now; we have got to start sometime.

Mr. Regenstreif - Planning Secretariat

Could you bring us up to date on what is happening in the Maritimes with regard to the problem you spoke of earlier, namely the fact that 78% of your energy consumption has been going up the chimney.

Mr. Wells

Virtually nothing is happening to date. I have tried to outline the approach that we want to take. In many cases the central plants are now located in places where it is almost impossible to make good utilization - economic utilization - of the wasted heat. The plants were built when energy was so cheap that people did not give a damn about wasted heat; the heat was just pumped into the bay or the river, or into the air. Virtually nothing is being done with existing plants. There are some experimental approaches being suggested in Nova Scotia with new operations but again there is nothing concrete yet. I do not think that they are even as far along as we are in planning possibilities.

Dr. H. Rempel - Economics Department University of Manitoba

Mr. Wells, where does the technology come from? Somehow you seem to start in the middle of no where. You assume that technology somehow starts and determines everything else. Now I do not have much quarrel with the results or implications of the technology that you speak of, but where does it come from in the first place? You make such blanket statements as "we have been seeking labour-saving technology no matter how much it costs". I would like you to cite one single illustration of that.

I would argue that technology, in a very real sense, reflects the relative costs of the factor inputs. Now if you want to argue that a company develops a particular technology here - say for example Labatt's Brewery - then it goes into Kenya and uses exactly the same method of brewing there even though it is totally inappropriate in Kenya, then I fully agree. However, that is hardly a relevant example to justify your blanket statement. Any company that goes into a developing country is thinking in terms of a two to five year time horizon. Given that short time horizon, it does not pay for them to look for an appropriate technology in that local setting. Therefore I really am at a loss for a single example. You state, as I understood you to say, that looking for resource saving as opposed to labour saving technology is going to be something radically new for our engineers. Yet certainly in land (and land is in many countries the constraint of farming) the engineers and scientists have done a tremendous job, but so again this reflects the relative prices. You could talk about a foundry that can be produced for a hundred pounds - this is great, that is technology in the abstract - but the real test is when you want to produce a particular product in a given environment. In terms of a relative costs of all inputs which foundry is going to come out ahead. In a less developed country, the hundred pound one may come ahead of a larger foundry, but its not clear that it will do so in another setting. I would argue that it is really the range of products that we want to have, the output we want and the relative costs of the inputs that determines technology rather than somehow it emerging as a conspiracy, as some sort of a conspiracy from some technologists who are ruling us from above.

Mr. Wells

I am sure I will not do justice in my answer because unfortunately, like the speakers before me, I do not have a recorder in my head that I can play back. However, you asked for one example of the technology which is geared or operates in such a way that it does not really matter how much energy or how much resource it uses in its operations. I think the example that comes to mind immediately is the whole petro-chemical industry which studies have clearly shown to be the greatest users of energy in the manufacturing sector to produce the fewest amount of jobs per dollar invested. At the same time it is using a resource which is depleting to gradually put out of business the very vital, valid and useful small scale operations. (For example, the plastic handbag is quickly replacing handbags made of leather - which I think most people will agree were a better product than the plastic).

I am not suggesting that there is some ogre in the sky overseeing all of this and imposing these things upon us at all. I am suggesting that we have allowed ourselves as a society to drift into these things. We have allowed these kinds of technological answers and approaches in essence to take over the direction that our society is running in. This has been to the very serious determinant of many areas of our country, many provinces in our country, many people in our country. Terms like "technology is running wild", I do not think are exaggerations at all. Once the thing is unleashed it seems to have a motor of its own and it carries on remorselessly.

With respect to people who move into a developing area, sure there are time horizons - two or three years, but I am not sure that we can socially allow that to continue; it is too exploitive, it is too short termed, it does disrupt and disorganize existing cultures and existing values, and does not replace them with anything that is permanent and useful. We have to watch these things very carefully; we have to control them. We have not been very good at controlling these things in the past and in fact, not only have we not been good at it in this country but even worse in my opinion, we have promoted this type of development.

Les Tough - Industry and Commerce

You speak as though there is some kind of dichotomy to the extent that one must choose whether he wants to belong to the Conserver Society or as part of the society that leads the scale economy. I personally feel that one can live in harmony with both, that the two can complement each other. I do not think anybody can disagree with the basic philosophy of the Conserver Society; it is rather like motherhood. It is certainly the direction that has to be taken. One of the major challenges that we have is how to use energy efficiently. One example mentioned was the central plants in P.E.I. where 78% of heat is wasted. I think that there are a great many other examples of where low grade heat-energy is wasted - thrown away - in nuclear plants, in internal plants, in industrial waste, and in bio-mass waste. I would ask the question "What is being done: what is being done to examine the possibilities of this low grade energy?" You have more or less disposed of that question but it would seem to me, whether you are talking large scale plants or machines or small scale size enterprise, that efficiency is the key. I think this is one area that should certainly be looked at.

Mr. Wells

I certainly did not want to leave the impression that I disposed of that question. I thought the example that I gave of one thing that we are doing or want to do in P.E.I. was only that, an example of how we are going to use the low grade. I talked about an energy plant as opposed to an electricity plant because of the application of all of the excess energy that would come off such a plant being put to appropriate and useful purpose. Present plants, which were never designed with these purposes in mind, cannot be easily changed. If you have a plant like we have in the middle of downtown Charlottetown, what are you going to do with all that low grade heat? To start tearing up the streets and re-converting furnaces is an extremely expensive operation for a plant that may hopefully be phased out of existence in the not too distant future. I agree that efficiency is the key but I do not agree that the issue of small versus large scale is of no consequence in the pursuit of this goal. The larger the plant, the more difficult it is to find appropriate uses for that low-grade heat simply because of the amount of heat that is being pumped out. In our examination we have discovered we can look at from a 1 to 5 mega-watt plant as being a useful size if we are going to use appropriately the excess energy. If we were to put up a 50 mega-watt plant as someone suggested and if we have enough fuel to run it, what will we do with the excess low-grade heat? There is too much of it. We cannot possibly use it all. However, by scattering these smaller plants throughout the province and doing very specific things according to where they are we can start looking sensibly at the use of the heat.

You made a comment at the outset that you thought that we could live with both approaches. I suppose that is possible but I think that if we are going to take that attitude we will have to be very careful in our costing, our social and economic costing, to make sure that those people who do not want to live in so-called Conserver Society way are paying full dollar for the rights to live in another way; that is not the case today. Sure we can tax automobiles - that is a beginning move - but I think that we would have to do much more than that to put everything in the proper perspective.

7.

NOT GLOOM AND DOOM BUT PROFIT AND BOOM IN A CONSERVER SOCIETY

Dr. J. Graham Smith
Professor of Management
McGill University and
Associate Director of the
GAMMA Group

First, I should like to compliment the Economic Development Advisory Board and the Manitoba Research Council for their insight in choosing as a title for this conference "Business Opportunities in a Conserver Society".

Too often, the Conserver Society is presented in the Press and elsewhere in a negative, anti-business way. We are told of energy constraints, of non-renewable resource depletion, of excessive pollution and environmental degradation. Business is often used as the whipping boy of these social critics. "If business didn't do this. If business hadn't done that, then we'd all be better off than we are." This is a very familiar refrain. What many critics of business and businessmen often seem to forget is that if it were not for business and individual businessmen, in the first place, many of us would not be housed, clothed or fed as well as we are, nor would we have the leisure time to enjoy the very many comforts and conveniences that we do have today.

So, to me, it is refreshing and exciting to see that in this province, especially, the initiative has been taken - in the way it has today - to think in public about the <u>opportunities</u> for business in a Conserver Society.

On the other hand, where there is smoke there is fire and businessmen are not completely innocent of the charges levelled by their critics. I would like to illustrate my point with a little story. A few weeks ago I had some tickets for Schubert's Unfinished Symphony which was playing at Place Des Arts in Montreal. Unfortunately at the last minute I could not go and so I gave the tickets to a friend of mine who was an efficiency expert. The next day I bumped into him and I asked how he enjoyed the concert. Do you know what he did? He gave me a five page summary. I will quote from parts of the summary:

> "For considerable periods of time, four oboe players had nothing to do; their numbers should be reduced and their work should be spread over the whole concert. In this way you can eliminate peaks of activity.
>
> "Too much time was spent on playing the demi-semi quavers - this is really excessive refinement - notes should be rounded to the nearest semi-quaver.
>
> "Overall there was far too much repetition in certain passages. Why do the violins repeat what the horns have already played? Indeed if all such redundant passages were eliminated, then the concert could have been cut by at least twenty minutes, and with this twenty minute saving there would not have been need for an interval and, finally, if this interval period had been eliminated perhaps Schubert would have been able to finish his unfinished symphony."

This little anecdote is not just levity because it does illustrate a moral that I would like to talk about for a few minutes. Like my efficiency expert friend, many businessmen today (and I think, you will agree to some extent) frequently, in the interests of efficiency, seem to sacrifice effectiveness. In other words, businessmen diverted by the sort of daily pressures of inter-office rivalries (the competitive this, that, and the other and so on) do not perhaps really recognize that the top managers job today has changed a great deal from what it was twenty or thirty years ago.

Twenty years ago, the top manager had to be a very capable trader. The resources were there and he just had to get them at the lowest price. He could rely on past experiences and he could extrapolate from his past experiences with a reasonable degree of certainty that more or less what had happened in the past could be anticipated to happen again in the future. But today (and I think this conference is demonstrating it extremely well) good management means frequently bringing an enterprise through a successive series of radical changes into completely new areas, and out of obsolete areas. It means adaptation to a series of shifting economic and social forces and it means responding frequently to circumstances that have very long-term implications. Now if you are always worried about what you are going to do tomorrow morning at the corner of Portage and Main you, as top managers, are not going to have much opportunity to wonder whether or not what you are going to do tomorrow morning at Portage and Main is the effective thing to do for you as a businessman, or for you as a responsible member of society. The fact that businessmen may sacrifice in the interests of efficiency some effectiveness, is the aspect of this so-called Conserver Society concept that I am personally interested in; in other words issues involved with long-range planning.

Resources: Pollution and Growth

The point has been well made by all speakers today, that we are in a period of fundamental transition; that the soaring sixties have given way to the sagging seventies, and that we are entering the resource scarce ecological eighties. Will the coming decades be ones where there are limits to growth, as the Club of Rome has predicted? Or will these be years in which business can prosper and flourish?

I would like to suggest to you that we have beclouded the issue a little by being somewhat restrictive and lumping everything together under the term "The Conserver Society". In my view there are many different kinds of Conserver Societies.

Before we are through some kind of social revolution there may very well be Conserver Societies similar to the ones Andy Wells has described earlier today. Altruism, if you wish, in some form or other will take over and individuals will not voluntarily commit themselves to lives which are less resource profligate and pollution intensive. This altruism will occur as people recognize the social benefits of such behaviour for society as a whole. In our work at Gamma we call this the "Buddhist Scenario". The basic idea behind this scenario can be summed up by saying that in a materialistic sense people will be doing less with less but that to do a change in life-style people will be getting greater satisfaction in a personal sense.

This is certainly one kind of Conserver Society I think we can envision. In fact, some of the young people and some of the not so young executive drop-outs have taken this route. They have become fed up with what is going on right now. They do not like the rat race and they pulled themselves out of it (or they may never have entered into the rat race in the first instance). Although this is an option which some Canadians may choose, personally I do not see it as something which the majority of Canadians will adopt in the near future. And, it is about the near future that I really wish to talk today. For those in the less developed regions of Canada, for the disadvantaged, and others who have not had the opportunity

to enjoy the benefits (and these are many) of economic growth, any question of whether to slow it down further, or to alter its focus, will not only seem inappropriate but malicious. A likely response from such people would be why should the elite who have enjoyed the two cars per family, the summer and winter house, the electric toothbrush, the vacation in the Bahamas now suddenly tell us that we cannot aspire to the same. If we can enjoy higher incomes why should we not? What do we care if, in the process of working in an asbestos plant we are ruining our health and perhaps upsetting the ecological balance? If we do not work there where will we work? And, if we can work why can we not spend our wages as we wish? The same response too, I think, is likely to come from developing countries vis-a-vis the developed.

To respond to these, and similar statements, by arguing that you cannot because during the past forty years or so we have abused the environment so much that it cannot sustain much further abuse from either of us, is likely to receive, and deservedly so, short shrift. To respons to such questions by saying do not sorry we will share with you the present fruits of our past economic growth is also likely to be greeted with a cynicism bred out of prior experience that things just do not work out that way.

Can we limit growth? I think not! Growth is an essential part of an individual's,or any society's make-up. The real question is what kind of economic growth should be encouraged in the future. Moreover, who or what should do the encouraging: the state, the market, or more likely, some mixture of the two; and what should be the balance here?

Should there be more or less government direction and control of the economy? Might it not be possible, for once, to have less government direct intervention in our daily lives?

Could we not use the profit motive to penalize polluters and reward resource conserving industries? In this process, could we not, indeed, develop many future growth industries and business activities, industries which stressed efficiency in resource use and the recycling of post-production or post-comsumption wastes? Moreover, what is stopping such industries from growing now? Why do so many recycling firms go bankrupt? What needs to change for this not to be so in the future? In sum, how can individual businessmen prepare for, and manage, the challenges of a resource scarce, rather than resource abundant, future? These are the real questions which you as businessmen will have to address yourselves to in the context of the Conserver Society. But what is a Conserver Society?

To me a Conserver Soceity is not one which opts just for energy conservation, although energy efficiency in production, transportation, distribution, marketing and retailing will be a principal goal for such a society. It is this, but it is much more. It is the kind of society which tries to reduce waste in production, distribution and consumption, and especially the awesome waste now so prevalent in many of our government and bureaucratic structures. It is the kind of society which stresses doing the right job, rather than just doing the job right. It is the kind of society which plans for the future rather than reacts to present and past crises. It is, in other words, a society which responds to ecological imperatives, be these perceived as threats or opportunities, but turns threats into opportunities.

Such a perception of an Conserver Society could be called the selective Conserver Society with a conservationist growth option in it.

Such a society is one which tries to do more with less; it tries to be efficient and effective simultaneously. I think that the more with less kind of conserver society rather than the less with less kind will probably be more palatable to the largest number of Canadians right now.

Business Opportunities In A Conserver Society

What are the opportunities for business in such a society?

Given time constraints, I can only mention a few of these today and these only in broad outline. In a basic sense, however, the opportunities are as wide, or as limited, as is the entrepeneur's capacity to perceive them. Let's look first at the energy picture.

Energy

You are all familiar with President Carter's recent statements on the U.S. situation. In Canada we now have the dubious distinction of using the most energy per capita of any country in the world. So obviously there is need for change.

There is no doubt that in the next few years energy from conventional fossil fuels will become more expensive. Excluding social and environmental costs for a moment, in straight dollar terms, energy production costs will rise as long as less and less accessible sources - e.g. the Tar Sands, are used. A similar situation is likely to prevail for electric power costs. Consequently, as costs rise, there will be immense opportunities for businesses which specialize in helping to reduce these costs. Industries which can provide energy efficient technologies are bound to grow. Similarly, in-plant energy conservation programs - and specialists in this field - can look

forward to a bright future. In the energy context, a dollar saved can well become more than a dollar earned in the future, especially given taxation burdens. In the short term then, before coal as an alternative energy source and certainly before any movement to solar, wind, geo-thermal, tidal or any of the more distant energy sources are adopted, there will be a strong demand for energy efficient technologies and also for a labour force skilled in their application.

At the plant level, and in the near term, new systems which prevent heating and cooling losses will be encouraged, as they become economic. So, too, will retrofitting of machinery and equipment to eliminate unused or underutilized energey. Firms specializing in both activities will spring up. Engineers will be encouraged to apply their knowledge or design changes to make processes energy efficient. Consulting engineers will thus have immense opportunities to exercise their acquired skills and to develop new ones.

More insulation of industrial buildings - to avoid heat loss - will become practical. This will stimulate not only development of new insulation materials but whole new processes and applications for existing materials. Secondary manufacturers, specialized in the provision of such materials and their industrial and residential installation, will be established.

As industrial firms begin, as they undoubtedly will in an era of expensive energy, to consider the life cycles of their energy inputs, a variety of changes will occur in industrial building design; in warehousing and storage; in refrigeration; in inventory handling and in transportation and delivery systems. New standards will develop where energy savings over the plant's expected life are offset against higher initial capital construction costs.

Inventory control systems will need to be redesigned, perhaps inventory size will be considerably reduced, especially if capital is tied up in inventory because of energy needs. This in turn could lead to the development of entirely different inventory systems than we are used to. The frozen food business, for example, might undergo radical change and this in turn might then substantially affect much of contemporary food processing and distribution. Alternatives to high refrigeration cost items will need to be developed. There is great scope of business enterprise in this area and profits potentially could be high.

The whole concept of convenience foods and current methods of packaging offers tremendous opportunities for innovative product managers, for marketing people and for people who can redesign packaging systems. Currently, we are generating six pounds of garbage per person per day in Canada and much of this garbage is in the packaging for these so-called convenience packaged foods. Especially, if we can get a better measure of the social costs for much of our post-consumer waste and if we can tag these costs onto the costs of production, then the whole packaging industry will have considerable motive to re-think many of its approaches and structures. The end result, aside from the rewards for the enterprising, would be increased energy efficiency and more energy conservation, not to mention less post-consumer waste.

Similarly, firms might look very seriously into the prospect of reducing energy costs through renting rather than owning equipment, machinery, transportation and so forth. If a thoroughly energy efficient rental system were introduced it would have the distinct advantage of spreading the intial

costs out over several users and also of maximizing use and, thereby, minimizing the down time now built into all systems to handle peak load situations. It is likely too, that goods built for rental would be much more durable than those not built for this purpose. Look at telephone receivers - these are durable, there is not much built-in obsolescence. Another example would be hotel beds as compared to the kind you normally can buy in stores; they are durable and long-lasting.

There are many advantages to rental systems from the cost effectiveness viewpoint too. To return to the inventory situation again. There could be cooperative central energy efficient warehouses. Scale economies could operate here to the advantage of all firms. Industrial firms could rent inventory space, refrigeration space and so forth. From these central depots delivery systems could fan out through any city. Multiple deliveries could be made on one journey and so forth.

Now I grant all this would take more organization than is presently the case and there might, initially, be foul-ups. But here lies a real challenge for managers. How do you make these new systems work? Again, specialists in these fields could command high salaries or specialist firms could expect high profits. Perhaps they could work on a commission, partially based on energy savings realized. There are a hundred and one variations of the theme and the opportunities for business, I think, are only as limited as is the insight of entrepreneurs.

The point I am trying to make is that industries which can provide energy efficient technologies are bound to grow. If you, either as an employee or as a firm, can save somebody some money by providing an energy saving

service and if energy becomes expensive as it is obviously going to become expensive - certainly compared with anything we have known heretofore - then you are going to have a pretty good pay cheque or a very viable business.

I saw an advertisement in the newspaper a few days ago for a resource conservation engineer and believe it was put in by the MacDonald hamburger chain. So you can see some of these things are already beginning to happen. They are not starry-eyed wonders floating off in the middle of space somewhere. They are real hard kinds of things.

Recycling And Resource Conservationist Technologies

As you all know, resources are being continuously changed in both production and consumption. There are intended outputs (the car, house, artistic concert, whatever) and a variety of unintended by-products (i.e. the thermal pollution which accompanies a pulp mill's effluent discharge; the six pounds of garbage per day per person which Canadians discard.) In other words, there are a variety of social costs and consequences to our current production and consumption practices which, at present, are not accounted for either in the profit and loss statements of firms, by government in their planning or by individuals in their daily lives.

Pollution abatement after the fact is costly. If we encourage the recycling of post-production wastes, we not only reduce the potential for pollution but also use our resources much more efficiently. If this is so why is recycling not already widely practiced and why do those firms now in the business frequently not last too long? There are several reasons.

Much of Canada's economic life is still largely based around the extraction and export of virgin raw materials. Until a few years ago these were thought to be abundant and were relatively readily accessible. Depletion and depreciation allowances encouraged the growth of extractive industry and, in simple dollar terms and largely because of the scale economies associated with this process, it was simply cheaper to use virgin resources in production than to use recycled materials. It is becoming less cheap to do this now. But, in many instances, the full costs of using virgin resources are in no way yet properly accounted for. Today, while the higher capital costs associated with the extraction of less accessible resources are being recognized, the social costs of environmental degradation and post-production pollution are not yet fully appreciated.

As far as post-consumer waste is concerned, the story is similar. Only recently have the full costs of garbage collection and its disposal through antiquated land-filling techniques (which of course takes much of the best land around cities out of potential agricultural production) become to be recognized as real costs. To fill land with non-biodegradable plastic and chemical by-products poses a burden on us all. We are only gradually beginning to realize the extent of this burden. The story is similar as far as our water supplies and other fundamental necessities of life are concerned. Slowly we are coming to the realization - as we have with energy - that there must be more effective ways of using and disposing of resources. The problem, of course, is as you well know, labour costs. It costs lots of money to sort all the junk from non-junk; to separate the tincans and the aluminum cans, and the plastics from the rest of the garbage. In this context, the Americans are doing something

that I do not think we are doing very effectively yet. American Can, through its Americology scheme, has already - I believe it is in Milwaukee - got in place a shredding and separating plant which is expected by almost 1978 (I might be slightly off on my figures, but I think it is 1978) to be able to, in effect, separate and take out much of the materials constituent in refuse and recycle it back as a secondary resource input into new kinds of production output.

I believe there are immense opportunities in the recycling business. However, I do not think these prospects will be fully recognized without a thorough reappraisal by government of its position as far as recycling industries are concerned and in this context I would suggest that in the future the federal and provincial governments in Canada should use their taxation capacities to give a real break to recycling industries.

How? Principally, I think, through the use of tax incentives. As you all know, the amount you can save on taxes reflects in your annual profit and loss statement. If you pay less taxes not only do you make more profits but you can also afford to lower your prices - other things being equal - and thereby increase your market share. This can often lead to higher total profits.

In order to promote recycling industries in Canada then, governments need to give these industries a variety of tax breaks. Government needs to do essentially the same thing, I think to encourage the growth of resource conservationist technologies. There may be differences in detail here, but not essentially in approach. In both cases, I would suggest that the most efficient way would be to make these tax benefits rather like those now granted for depreciation on capital assets. Such an approach would have

three major, and relatively quick, effects as far as encouraging both recycling industries and the growth of resource conservationist - appropriate if you like - technology.

First, a boost would be given to present recycling industries. Their operations would be put on a more competitive basis, or rather would no longer be in a non-competitive position. The savings, as a result of the tax benefits, could be passed on to the consumers in the form of lower priced final goods; this should have the effect of increasing the market shares of the industries and in turn they would be better able to enjoy the scale economies which come about through larger size.

Second, the tax incentive would encourage the movement of people and ideas into the recycling sector. With the prospect of substantial profit forthcoming, resource conservationist technologies of all types would be encouraged rather than discouraged, as is so often the case at present.

Third, many of the contemporary primary resource users -- if their competitive disadvantages became great enough through such tax burdens - would themselves be encouraged to seek out alternative technologies and production processes. Not only might they switch to greater use of recycled material inputs and thus further help the recycling industries, but they probably would get into the recycling business themselves. In social terms this would be most advantageous. It is in our larger firms that we frequently find many of our most talented scientists and engineers. They are attracted to such firms by high pay. Much of this talent is, I wager, now underutilized in a social sense, at least.

Expensive scientific time in this country is now spent frequently on minor product differentiation rather than systems innovation. However, if top management - through the tax system such as that proposed - begins to realize that there are significant cost disadvantages to staying with present technologies they will begin to press for system redesign. In this context the talents of our engineers and physical and social scientists can be fully utilized. It will become profitable for management to unleash these talents toward the solving of some of our environmental and pollution problems. Thus rewarded for their efforts, and given technical and other support, personnel and facilities, we could, I think, see immense and beneficial changes for Canadian society being brought about by these engineers, and in short order. Right now the scales are stacked against the use of some of our best talent in this way. With an effective tax stimulus we might not only get "appropriate technology" but a rewards system which would also be appropriate for those inventing it.

One further advantage of this approach, I think too, is that even a partial implementation of such taxes could go a long way to bringing about a more optimal flow of resources, human and material, in Canada than is presently the case.

Such a tax incentive system could foster socially desirable growth by providing for a better understanding - in money terms - of each other's concerns by both industry and government. The shorter term competitive survival of firms could thus become more compatible with the longer term objective and outlook of government planners. The competitive system or the market system reacts to relative prices and costs. Businessmen tend to move into areas of production where the gaps between prices and costs are the greatest (and rightly so). However, these actions

will be compatible with the longer term interests of society (the realm supposedly of government planners) only if the full costs to society of the use of each type of input in the production process are reflected in their prices. I see the use of tax incentive system as a way to change the relative price structure and it would seem to me that there would be immense opportunities for the businessman once this has been done.

Okay - you might say, if there are social benefits to be gained, why does not government simply legislate that we use recycled materials. Well, as you all know there is such a thing as bureaucratic waste - which is certainly a demonstrable form of pollution - that is very considerable and it can 'muck up' the profit/loss picture for any firm. Much of the uncertainty which currently faces Canadian business today about government goals and objectives - and much of the bureaucratic pollution which accompanies this uncertainty would be eliminated if a greater coincidence of private and public objectives could be attained in the market place via tax induced changes in relative prices.

At the moment we have no effective industrial policy in Canada. Heaven knows we certainly need one right now. A tax incentive system would be an effective way of communicating to the businessmen just exactly the goals and objectives of government; the message would be communicated in monetary terms - in accounting terms - and businessmen could incorporate such information into their profit and loss calculus. Such action by the government could provide a meaningful base around which to develop an industrial strategy. Moreover, with such a policy we might, in Canada, at last begin to use fully the talents of our younger scientific establishment for the development of Canadian solutions to Canadian problems.

Many of our best young scientists and technologists are now unemployed or underemployed. This surely is a pathetic waste of human resources, especially considering the country's past investment in their education.

Finally, and where appropriate, we could export our solutions abroad. In this way we would recapture some of the initial losses we might sustain by moving toward a recycling and less resource intensive economy. There would be, especially given President Carter's recent statements, substantial markets in the U.S. for truly innovative technology. At a different level, we could also offer such technology to developing countries - when appropriate - as part of our aid package. My suspicion is that most of the kind of technology we would develop would certainly be much more appropriate to their real needs than that which we now make available. You are all aware that CIDA spends over a billion dollars a year of the taxpayer's money in providing aid for developing countries. I say this in all seriousness having spent about three years of my life in two African countries and having seen all kinds of large harvesters and other pieces of hardware simply rotting away in the field for lack of either spare parts or knowledge of how to use these things.

Marketing and Conservation

I have made the case above for the benefits of recycling and the development of resource conservationist technologies in Canada basically in cost, price and profit terms. However, given all this, there might still be considerable public inertia to be overcome, especially in the short term. This, I think is why thers is such a market right now for the marketing of conservation and the principles of the Conserver Society.

Presently we associate disposability with affluence. How many pop bottles, kleenex, ballpoint pens, or disposable razers have you thrown away today, this week, this month? Probably, if you are like most Canadians, quite a lot! Moreover, the media are continuously insisting that you, and I, throw away more. We can resist such advertising. Indeed, we might become so annoyed with the banality of many TV commercials that we deliberately do not buy Brand X but choose Brand Y - the one the commercial for Brand X panned - instead. But obviously advertising and in practice (TV, radio, billboards and all other forms) still sells. Advertising is a multi-million dollar business in this country and if it did not perform for its sponsors, there would not be sponsors. So it is a very strong force - for good or ill - in society. Can not this very persuasive and effective medium be used to get the conservation message over to us? I think it can and would suggest that there are opportunities aplenty for existing advertising and other promotional agencies who will turn their talents to selling conservation and conserver goods and services.

Even though the economics of energy and depleting natural resources might dictate a change from a consumer to a conserver society in Canada, it is necessary that a massive transformation of attitudes, beliefs, values and behaviour, certainly in the short term, will have to occur before any changes <u>are</u> accomplished.

Every economic organization, other than the isolated self-sufficient family unit, needs an effective distribution, exchange and communications mechanism. In complex societies like ours, marketing moves people, goods, services and ideas from one place, or form, to another place or form.

Marketing is then a provisionary technology. Its techniques and strategies can be used, and are used, to stimulate and support change. Precisely because of this, marketing in any complex society, consumer or conserver, will be fundamentally necessary.

What are some of the specific areas of opportunity?

a) Marketing: Responsible Consumption

There will be immense opportunities for those now in marketing to use their proven techniques to bring about a reform in the inefficient consumption habits of Canadians (i.e. to inform and persuade Canadians that it is to their personal benefit to drive smaller cars, to use public transit whenever possible to conserve home heating fuel, to insulate their houses, and to buy goods or consumer services which are energy efficient). In this context a panoply of techniques can be used. Surveys will need to be undertaken. Results will need to be analyzed and effective promotional campaigns developed. The client initially for these services probably would be government. However, the private sector - in its own interest - will, I venture, also become a significant source of revenue for market research and advertising agencies when they discover the cost saving in educating their employees to turn off the lights or the lathe or whatever.

You know, I was tempted to raise my hand this morning, Mr. Chairman, and point out one of the very inefficient consumption habits that was taking place in this room. I did not do it this morning but I will do it now. We all had presentations given to us with figures and everything, yet we also had a slide projector here. I do not know how many kilowatts of electrical energy it was using, but it seemed completely redundant to me to have the

material in front of us and also to have it shown to us on a screen. Now there is something wrong but we are all used to that kind of thing, are we not? That is the problem; we do not recognize it as being wasteful. We are all used to it, it is all part of the game, we do not even recognize it as being wasteful but it is an inefficient consumption habit. It is a habit that we got used to. Another example is in the lighting in my office. You know I cannot even turn out the lights; there are no light switches anymore because my office was built at a time when it was felt that it was much better to have the long-lasting flourescent bulbs, and I have gotten used to the lights always being on. There is a whole host of these wasteful habits that informational advertising can bring home to us.

b) Marketing: Recycling and Reverse Channels of Distribution

Although many of the technological capabilities already exist to recycle much more of our past production and, especially, post-consumer wastes that is presently the case, there are a variety of social obstacles and barriers to the acceptance of a recycling philosophy in this country. The most significant of these perhaps is that at present there are no really effective reverse channels of distribution (i.e. mechanism to get back from consumers that which otherwise is thrown away). This is where marketing can play an immense role in the future.

Take one simple illustration. Right now the labour costs associated with separating and sorting garbage are so high that it is not economic for firms to consider this option seriously. The amount of energy and materials constituent in waste are, however, also very high. Marketing can help

consumers to perform this function. It can encourage people to separate and prehandle their garbage; it can encourage people to take their cans, bottles and paper to central depositories. Marketing can use a panoply of accepted techniques to accomplish these ends. Firms can devise cash bonus and benefit schemes, provide informational advertising and a variety of other approaches to this end. Marketing management, in other words, can adapt its proven forward distribution techniques to create reverse distribution channels to the net benefit of Canadian society and, what is more, make a profit out of it. There are some real challenges here.

c) Marketing and Packaging

The packaging industry in Canada had sales last year of $3.4 billion. It consumes huge amounts of paper, glass, metals, wood and plastics. To many it is seen as a source of great waste in contemporary society - there are few who could argue that all packaging is unnecessary. However, packaging can reduce spoilage and certainly increase consumer "convenience". There is a need for some packaging. In an age of scarcity, the marketing manager will have his job cut out to develop, design and implement new approaches to packaging, and physical distribution. Individuals will still consume in a Conserver Society. What they consume and how these products will be packaged and distributed in as ecologically benign a way as possible will provide a challenge of unprecedental proportions for the astute marketing and product manager in the future.

d) Marketing and Product Upgrading

For the past thirty years or so mass production has required mass consumption to survive. In the process, products have been built to wear

out quickly or to become obsolete as fashions have changed or minor product or style innovations have occurred. In any age of scarcity, a new challenge for marketing managers will be to convince consumers that they should purchase products even at higher prices that will last longer, are of better quality, and have several uses rather than one specific use. The consumer will have to be re-educated. He will have to be encouraged to pay for maintenance and repair services which increase product life. Similarly, consumers will have to be informed - through advertising and marketing - about system changes. New concepts - such as transportation systems that can replace single cars as the only viable means of getting from A to B for individuals - will need to be explained. Product upgrading, and product extension - through incremental changes to products instead of the purchase of completely new products - will also need to be explained - marketed if you wish - to consumers.

e) Marketing: Non-Profit Institutions and Government Agencies

In recent years, marketing techniques have been used to sell birth control, nutritional standards, flood and disaster avoidance, hospital programs and a variety of social services of all types. The need for this kind of specialization is not likely to diminish in a Conserver Society. Indeed, in the early stages, the opposite is more likely to be the case. Similarly, governments at all levels will require very effective advertising campaigns if they are to sell Canada on becoming a Conserver Society. Here lies the opportunity, I think, for even greater specialization profits, and growth of individual firms in future. For evidence of this all you have to do is to look at what is going on right now in the U.S.A. with attempts by President Carter to sell his ideas to the American public.

In addition, there might be considerable non-monetary rewards. The psychic satisfaction of selling something you can believe in, rather than despise (and who among you have not heard the tale of the frustrated writer who becomes a copy writer while he/she is waiting to have his/her novel published) could be great. Individuals can not and should not, of course, be expected to live on psychic income alone. However, in a Conserver Society, this could assume a greater significance to the individual than it does today. So in this regard, I am most optimistic too, as I hope you are.

Employment: Productivity And Government Regulation And Control

I have emphasized throughout my talk today a few of the many opportunities which I see for business in our transition to a conserver society. Several of you may still be skeptical about the effects this may have on employment, productivity and our international competitiveness.

I do not have completely reassuring answers. However, I would like to suggest that as far as employment is concerned a conserver society could lead not only to higher levels than we now have but to much more meaningful kinds of employment for many people than is currently the case.

As most of you are aware, direct employment per dollar of invested capital is lowest in our electric utilities, the energy industries, minerals and perhaps in highly mechanized agriculture. These sectors also are the major users of our capital resources and, of course, we currently rely upon them for most of our exports and foreign exchange earnings.

It is possible that movement to an energy efficient Canada, through conservation, could mean that capital now tied up in large power and energy projcts could become available for more labour intensive secondary manufacturing. Initially, as I have tried to suggest, it would be in such things as the retro-fitting and insulation businesses, and ultimately in such things as buildings designed and built to use solar, wind, geo-thermal sources of power . Thereafter, the possibilities are as wide open as is the imagination of the entrepreneurs who will provide a range of alternative goods and services.

More man-hours might, of course, be required to produce the same GNP, if we use less energy intensive practices. However, does this necessarily mean we are worse off in economic terms? As the mix of goods and services in the GNP changes, so, too, will its quality - and it is the quality as well as the quantity of goods and services - and especially the quality of working and leisure life that really counts after all. To try to use the same productivity measures in a Conserver Society as we do today would not only be inappropriate but quite misleading.

For example, I do not know how many psychiatrists there are in the city of Toronto right now, probably quite a few, and the psychiatrists probably average from 65 to 75,000 dollars a year in income. Now all of this gets factored in to our national accounts and Toronto is a very wealthy city and the psychiatrists are very wealthy section of that city. On that basis alone, we have evidence of really high levels of economic growth. Yet is the fact that there are so many psychiatrists and is the fact that these psychiatrists are so busy and is the fact that they are each earning so much money an indication of economic wealth and healthy, or is it an industrial disease? An interesting question to be answered, and there are many more like it.

A similar situation, to that above, would also apply in our export activities. If we de-emphasize our export of energy, raw materials and agricultural products, obviously we will suffer substantially in the near future. In the longer term, a different situation might result. If any real industrial policy for Canada, based on Canada's needs and capabilities, could emerge from this we might possibly be better off - qualitatively - than we are right now. Certainly, our bundle of imported consumer goods would change, but that is what a Conserver Society is all about anyway.

Finally, and I find it surprising that it has not been mentioned yet here today, I would like to suggest to you that the nature of the Canadian Labour Force,in terms of its age distribution, is changing very dramatically and what we can expect in the next ten, fifteen, or twenty years is a society where its working age group, the labour force, will be a smaller and smaller proportion of its total population. We are going to experience the reverse situation to what we have gone through in the 1950's when the children of the post-World War II baby boom entered the labour force. In the next ten, twenty, or thirty years these people will be leaving the labour force. Now in this context it would seem to me that from the purely employment side we probably really do not have fundamental problems in Canada from the 1980's on. As long as we have reasonable control legislation over immigration we may, in fact, have labour scarcity rather than an abundance of labour. Thus I would argue that we probably should not worry too much about the quantity of employment. The point about the Conserver Society as far as employment is concerned that I think is very important however, is the quality of working life. Even on this point I am optimistic. As Andy Wells

said in his talk, the quality of working life in a Conserver Society can be a much more satisfactory thing than it is currently for many in our work force. For instance, we could introduce the concept of flexi-time, as many firms are beginning to right now. So, in summary I do not feel particularly threatened on the employment side with the introduction of a Conserver Society.

Finally, a word about government regulations and control in a Conserver Society. It is possible, of course, that we could rely solely on government to implement a Conserver Society in this country. Regulations could be promulgated, standards set, taxes collected and rationing imposed. However I am not sure that Canadians are yet quite ready to give to government the power to dictate totally how we should live, eat, sleep, drink and think. Even the most benevolent of despots is still a despot. Moreover, is government necessarily more efficient or effective at delivering us our daily bread, or booze for that matter, than we are ourselves? I have my doubts.

This does not mean that all levels of government will not have to be intimately involved in any movement toward a Conserver Society in this country. Obviously they will and already are. But, I do not see the Conserver Society, necessarily, as only a one way street along which business labour and all of us, as individuals, are directed in response to government initiatives.

Certainly governments will need to encourage, persuade and cajole, if we are to move to a Conserver Society in Canada. They too, though, must put

their own houses in order and the regulatory burdens under which we all now labour must be minimized. If business is to become efficient, so too, should government become effective.

To conclude, in a nutshell, and from the viewpoint of private and public decision-makers, a Conserver Society means that greater forethought and planning effort will have to be given to using techniques of production, and technologies in general that impact on society in such a way as to be easily reversible if they are found to be detrimental. This means that, collectively government, business and labour must look beyond the next fiscal year or the next election or the next contract negotiation period in their decision-making processes. The stakes are too high right now for this not to be done. We have a job to do, let's all do it right!

8.

SUMMARY COMMENTS

Leonard Remis

Ladies and Gentlemen: We have had a full day and given the fact that we are already past our scheduled time of adjournment I would ask your permission to forego the discussion. However, if any of you feel strongly that you must say something, please feel free to do so.

I have asked John McGuire, our Research Director, to pay special attention to what has been going on today so that he, while thanking our speakers for efforts and messages, could perform the unenviable chore of providing us with a little summary.

John McGuire

I have been given what I think is a heroic task and I do not feel like a hero. I am not going to try to criticize or give my opinion of what has been said and not said, and what was wrong and what was right. Instead what I would like to do is to give what I consider to be a conceptual framework into which we can put all of the talk that went on today.

As I was listening today I seemed to be continually bombarded by information coming from all directions (and I should confess to you that the expression Conserver Society is new to me as it is no doubt to most of you). Suddenly at some point while I was trying to digest all of this, my experience as an economics professor came into play. A word came to my mind and that word was "scarcity". Almost every professor

in his first lecture in an introductory course in economics will define economics as a study of how a society allocates scarce means of production amongst many unlimited ends or desires. We, as a society, have only so many resources, so much manpower, and so much time - but we have unlimited wants. Economists study the problem of how society rations these inputs.

Well, I have always had considerable difficulty, as a professor, when I am facing the students - first year students - telling them that there is a scarcity in this world and that the study of economics is concerned with rationing scarcity, when all about them they see abundance. They say "what are you talking about? Scarcity! I can't understand that at all". After today I feel that I will be able to face the students with more confidence for it looks like the mentality of the growth, a concept we have had as a society for so long - the concept that our material wealth is limited only by our ability to capture it - is quickly going away. Once again the dismal science of economics can talk about scarcity with some credence.

Scarcity, however, has risen to mean something slightly different than it meant before. The traditional notion of scarcity was not so much concerned about the finiteness of our resources but rather our inability to process them at a sufficiently fast rate. In other words, scarcity was the result of our limited know-how or technology. Technology was - and still is to many of us - the great liberator; it was the way that we could be freed from the bondage imposed upon us by scarcity. (The earth's bounty is limitless and so too is our level of affluence if only we could develop the know-how to exploit another earth). Gradually, as our technology developed and our affluence rose, the bug about scarcity died away.

Now we have a new type of constraint; that is we are beginning to see that maybe there is a finite amount of resources, that there is a finiteness to our earth and that if we produce too many material goods, transform the earth too much, we are going to bump into a limit. The technology we have been developing, no matter how efficient it is, no matter how high its productivity is, has been increasing the rate of consumption of our finite resources. We have been and still are basically, a growth oriented society, growth that could be characterized, as Dr. Smith characterized it, as "more with more". Now, in contrast we are beginning to think again that we are indeed in a scarce world. The leaders in this new way of thinking all tend to identify, in one way or other, with the Conserver Society. No doubt there are some within the Conserver Society movement who would say that we should be satisfied with "the same with less" in contrast to "more with more". That is to say, as technology improves our productivity, rather than increasing our level of wealth we should decrease the rate of resource consumption. Then, there are those, like Graham Smith, who argue that we should aspire to "more with less"; that is to say we can still have growth in our wealth (or better our standard of living) if we pay attention to the waste in our current production and consumption patterns. Finally, there are those, like Andy Wells, who argue that we should have "less with less". Such people argue that much of our current demands for consumer goods do not really add to our standard of living in a qualitative sense; our lives would be richer and the threat of destroying our earth (by exhausting and polluting it - which are really two sides of the same coin) would be less if only we were to give up our single-minded fixation for

material growth. It should be noted that all three approaches often employ the same policies in practical terms. For instance, advocates of all three approaches would be in favour of recycling.

Two other words kept recurring in today's proceedings and they were "wasteful" and "efficiency". If you were to reflect for a moment you will realize that the two words are really referring to the same thing. To have our system charged with inefficiency and wastefulness, I thought was very interesting. We pride ourselves with being very efficient in every sense of the word. What other economic system could have experienced the progress that we have experienced. Only the efficient companies, the competitive companies can survive and grow in the market place. Look at the United States, the most powerful and affluent country in the World; American companies are the kings in almost every industry. Yet it is only the efficient companies - the ones that can turn out the profits, the products most efficiently, the least wasteful - that survive and make a go of it. So what are we talking about when we say "wasteful"?

The idea, when you think about it, is that until recently we were not concerned at all about the by-products (unless it had a market) of the goods we were producing. Now we are beginning to see that the by-product is costly. The packaging material that was referred to today, the use and duplication of energy, the throwing out of heat, these are all becoming wasteful. They are wasteful now because we are approaching some limits. Before it did not matter, things like pollution, things like packaging materials, things like throwing away heat, did not matter; now they are beginning to matter and therefore we are calling them wasteful. Wasteful, in other words, given my interpretation, is a word that changes meaning over time.

Now I would like to go on with another lesson in a first year economics course. It is not very far along in such a course before the lecturer will introduce the concept known as the production function. I would like to use the concept of the production function as the solidifying framework for all the talks today. The production function is simply a statement often written in mathematical form that says output (products) is a function of input and technology. The inputs or factors of production can be classified as either labour, energy, raw materials (including recycled materials), or capital. We have these factors of production and we mix them together according to some receipe (technology) and out comes the product that we want. I much prefer to call the production function a transformation function because what we are really doing is taking the World as it is and its natural processes and altering them to our own conveniences. We are shoving some dirt from here and putting it there, we are pulling some oil out of the ground, we are trying to take some energy out of the sky; in short we are taking the natural processes and transforming them into a form that we wish to have them in; they are then called products or by-products.

It seems to me that what the people in the Conserver Society Movement are saying is that we are entering into a period where we are going to have to look very closely at our transformation functions and we are going to have to make some drastic alterations in them. To use Dr. Hart's words, "it is a crisis of conversion".

Let us look more closely at the output of the transformation functions. Output, as I mentioned earlier, can be categorized into two groups. There

are outputs that we intend to have and there are the by-products. If we consider any society as a whole, we can think of a massive transformation function for all the goods produced and therefore we can think of a basket of goods and we can think of a basket of by-products. The economic system of this society determines what these products will be, given the inputs, the technology and the values that it has. I do not want to get into the question of how it got these values. However, I wish to point out that one thing the Conserver Society seems to be saying is that somehow our values are being changed or we are changing our values. We are in a period of transition; for some reason or other, we are being told or we are being pushed by some set of forces to alter what we consume. Increasingly we are taking into consideration not only the products, but the by-products. Within the aggregate or community-wide transformation function there is also pressure for change, in part due no doubt to the community's growing awareness of the by-products. There is increasingly a need, the proponents of the Conserver Society Movement argue, to alter the ratios of the inputs we are presently using, to stop using some of the inputs we are presently using, and to begin using some of the inputs that we are not now using.

It should be noted and emphasized that the people in the Conserver Society Movement are primarily interested in the community-wide production function. That is to say, they are primarily concerned about the production of goods and the implied consequences for society rather than the redistribution of income per se. The emphasis of their concerns is not centered about the problems associated with such things as poverty and unemployment except to the extent such problems adversely affect the necessary alteration of the transformation function. Nevertheless, they tend to believe that changes towards a greater sharing of our produced wealth are necessary components of the required reform.

The present economic system is not responding quickly enough to the changing conditions and hence we are in a transition or a conversion crisis. We, as individuals, and we, as a society with government as our agent, must take a direct hand in the process of change. At this point I think I detected some differences in opinion in the arguments presented today; the differences did not appear to be too great, however. First, all the speakers seemed to believe that some long term planning was required. Second, no one seemed to be arguing that the market system should be completely supplanted. For instance, Dr. Hart called for a more balanced approach in the development of our energy resources. We cannot rely completely on any one type of energy he told us. He also called for a strengthening of competition between the suppliers of the various forms of energy. Dean Siemens, in his talk, never forsook the individual farmer. Andy Wells talked about direct government involvement in the development of appropriate industries for Prince Edward Island, but essential to his argument was the need for the small enterprise and export markets. Dr. Smith talked about the need for government to alter the relative price structures of goods and inputs to reflect their true social cost, but once that was done he argued that the government should step back and allow the market to operate.

So what am I trying to say? I am saying that if we picture the economy as a living evolving thing, if we envisage it as a transformation function which has certain inputs producing certain outputs, then we can place all the arguments we heard today into one unifying framework. We are being changed; things are happening which influence the shape of the transformation function and things are going to continue to be changed by the market or by government, or by somebody. The Conserver Society is saying the change is

going to happen either by omission or commision on our part. We are either going to take a hand in it and make change orderly and rational in some sense, or we are going to let it change undirected. It is warning us. Now is the time to make the necessary decisions to help re-order the system and re-order our values.

Dr. Katz, Chairman of the Science Council of Canada, asked "What do we have to do?" He then answered his own question "We have to look at energy conservation. We have to see about developing new types of renewable energy. We have to worry about recycling and we have to develop new techniques". In effect he was saying that we have to fool around with the transformation function and that we need a new industrial policy to handle all of this. Then we had Dr. Hart of Atomic Energy of Canada Limited tell us that we have to start thinking about energy alternatives because they are becoming costly. "We do not have a crisis of energy, we have a crisis of conversion" he told us. Once again we are being told that we have to try as a society to find some way to shift resources around in the transformation function. Professor Siemens talked about food and food production, and what they meant for us. He talked about the limits of land and of the productivity of land. He talked about the encroachment on land of industrilized society. And he warned us that we had better start thinking about what food we are going to produce in the future, and how much. In the afternoon we had Andy Wells arguing that the whole system depends on the technology it uses. Therefore we have to alter our transformation function by introducing a new type of technology, a technology more in harmony with the natural processes or environment.

Dr. Graham Smith tells us that we, as a society, should be primarily concerned about (a) the nature of technology, and (b) the institutions that govern our production processes. In addition to discussing some of the areas where new technology can and should be used he spoke of some of the ways these changes could be introduced into the system. For instance, he spoke about the powerful influence of marketing techniques. Like the speakers before him, he talked about the need for a long-term industrial policy. However, he advocated, if I understood him properly, a strategy to facilitate change that is similar to my own way of thinking. Therefore if I may beg your indulgence I would like to elaborate somewhat on that approach.

Traditional economics, again we go back to that, has in its vocabulary an expression called the "invisable hand". This expression was coined by Adam Smith back in 1776 - the same year as the American Independence, interesting enough - relates to a particular idea. Essentially it meant that if you allow each individual to pursue his own interest, his own selfish interest, then that very pursuit interacting with everybody else's own interest, will generate the public good (it will be in the interest of all). This concept was thought to be a natural law. What I thought Graham Smith was saying was that the invisable hand mechanism, the pricing system, is still a valid instrument. However, for some reason or other the playing field in which the pricing system operates needs to be altered, and not left to natural forces. The system is not putting the full cost in the prices. We are not paying for everything in proportion to their true costs. Therefore we have to alter the playing field; we have to do things

that will alter the relative prices in the market system so that private action in response to the market prices will be more consistent with the public good. Dr. Smith does not appear to believe in the innate invisable hand. If you want the invisable hand to work you had better create the system in such a way that the relative prices will in fact reflect the actual cost to society. Once you have done that, then you can let people use their own initiative.

To conclude then, I will say that much has been said today and there is much to think about. I will certainly welcome the opportunity to re-read these papers as I am sure all of you do.

I would like to thank the speakers. I would like to thank Dr. Joseph Katz, the Chairman of the Science Council of Canada. I would like to thank Dr. Robert Hart, Vice President of the Atomic Energy of Canada, Ltd., I would like to thank Professor Siemens, Associate Dean of the Faculty of Agriculture at the University of Manitoba. I would like to thank the Premier for his very enlighting speech (you will notice I did not try to summarize his speech). I would like to thank Mr. Andy Wells, who is the Executive-Director of the Man and Resources Institute of Prince Edward Island, and finally I would like to thank Dr. J. Graham Smith, Professor of Management at McGill, and who is also an Associate Director of a group called GAMMA. Thank you all very much.

DELEGATES IN ATTENDANCE

Maher Abou guendia
Program Supervisor
The Canadian Wheat Board

C. W. Anderson
Information Officer
Pioneer Grain Company Limited

M. Basford
Co-ordinator/Regional Planner
Industry and Commerce

L. M. Batten
Consumers' Association of Canada
University of Winnipeg

T. W. Birt
Director
Business and Community Relations
Manitoba Hydro

W. V. Bowerman
Product Development Engineer
Manitoba Research Council

G. S. Bowman
Assistant Deputy Minister
Industry and Commerce

A. B. Buchanan
Special Projects Manager
Manitoba Telephone System

G. Campbell
Science Advisory to Cabinet
Manitoba Government

J. D. Campbell
Retired Professor of Horticulture
University of Manitoba

W. M. Campbell
Project Director
Wardrop London

J. T. Cawley, P. Eng.
Deputy Minister
Mines, Resources and Environ. Management

A. Cerilli
Representative
Canadian Brotherhood of Railway
Transport and General Workers

R. E. Chant
Director
Office of Industrial Research
University of Manitoba

B. Chochalacek
Economist
Industry and Commerce

M. Chochinov
MEC Secretariat
Industry and Commerce

M. D. Clarke
Director
Existing Enterprise Improvement
Industry and Commerce

B. Docking
Manager
Small Enterprise Development
Industry and Commerce

B. C. Dunsmore
Consultant
Winnipeg Economic Development Board Inc.

T. S. Durham
Industrial Commissioner
Winnipeg Economic Development Board Inc.

A. E. Earl
Director
Canadian Food Products Dev. Centre
Manitoba Research Council

D. D. Elliott
Director
Marketing, Distribution and Design Branch
Industry and Commerce

E. Elliot
Executive Assistant
Mines, Resources and Environmental Manag.

R. A. Gallop
Professor and Head
Food Science Department
University of Manitoba

R. Gemmell
Chief of Research
Manitoba Department of Public Works

L. Good
Director
Planning and Research
Department of Co-operative Development

L. P. Haberman
Planning Specialist
Corporate Planning Group
Manitoba Hydro

J. Hamill
Acting Executive Director
C.P.A.C. Manitoba Division

R. G. Hart
Vice-President
Atomic Energy of Canada Ltd.
Whiteshell Nuclear Research Est.

B. G. Hogg
Vice-President Academic
University of Winnipeg

H. Hossie
Promotion and Information Service:
Industry and Commerce

J. Kates
Chairman
Science Council of Canada

L. Katz
Director
Science Policy Secretariat
Government of Saskatchewan

D. Korn
President
Friendly Family Farms

M. Levy
Small Enterprise Development
Industry and Commerce

F. A. Macatavish
Director
Corporate Energy Utilization
Manitoba Hydro

H. A. Mackay
Manager, Technical Development
Manitoba Rolling Mills Division

G. Mackie
Secretary Manpower Employment
Executive Council

N. Malik
Senior Economist
Industry and Commerce

Greg Mason
Department of Economics
University of Manitoba

J. L. McGregor
Manager
Finmac Limited

J. McGuire
Research Director and Exec. Sec.
Economic Development Advisory Bd.

M. D. McKall
Manager Elec. Maintenance
Manitoba Hydro

D. D. Munro
Mill Manager
Abitibi Paper Company Ltd.

E. T. Oatway
Director
Technical Services
Department of Agriculture

G. Paget
Regional Planner
Industry and Commerce

S. J. Parsons
General Manager
Manitoba Development Corporation

E. H. Pepper
Professor of Botany
Brandon University

T. P. Pepper
Executive Director
Saskatchewan Research Council

M. C. Peppin
Public Affairs Manager
Winnipeg Chamber of Commerce

P. Phillips
Department of Economics
University of Manitoba

A. Regenstrief
Assistant Secretary
Housing and Urban Development
Planning Secretariat of Cabinet

L. Remis
Chairman
Economic Development Advisory Bd.

H. Rempel
Associate Professor, Dept. of Economics
University of Manitoba

E. Ripstein
Account Executive
Merrill Lynch, Royal Securities Ltd.

W. O. Salo
Supervisor
Commercial and Industrial Sales
Greater Winnipeg Gas Company

B. L. Scarfe
Acting Head
Dept. of Economics
University of Manitoba

Hon. Ed. Schreyer
Premier
Province of Manitoba

L. H. Shebeski
Chairman
Manitoba Research Council
(Faculty of Agriculture)

D. G. Sheils, P. Eng.
Branch Manager
Canadian Standards Assoc.

Prof. Leonard Siemens
Associate Dean
Faculty of Agriculture

A. A. Smith
Public Relations
Lakeview Properties Ltd.

J. C. Smith
Prof. of Management
McGill University

R. T. Smith
Manager
Customer Advisory Services
Manitoba Hydro

D. J. Snidal
Assistant Professor
Dept. of Economics
University of Winnipeg

A. Sparling
Associate Professor
University of Manitoba

J. Frank Syms
Chairman
Manitoba Liquor Control Commission

M. Z. Tarnawecky
Prof. of Electrical Engineering
University of Manitoba

M. Taunton
Economist
Manitoba Energy Council

D. Tomasson
Assistant Prov. Manager
Special ARDA Program
Dept. of Northern Affairs

G. Tough
Manager
Network Architecture
Manitoba Telephone System

L. Tough
Director
Small Enterprises
Industry and Commerce

G. S. Trick
Executive Director
Manitoba Research Council

G. P. Trithart
Provincial Manager
Special ARDA Program

W. P. Vieira
Securities Analyst
The Great West Life Association Co.

J. Vorst
Professor
University of Manitoba

W. L. Wardrop
Chairman and Chief Executive
W. L. Wardrop and Assoc. Ltd.

A. Wells
Executive Director
Man and Resources Institute
Prince Edward Island

H. W. Webber
Industrial Analyst
Department of Northern Affairs

M. H. Werner
Director
Project Development Branch

C. T. Williams
Vice-President and Manager
Tantalum Mining Corporation of
Canada Limited

J. C. Williams
Member
Manitoba Research Council

L. Wray
University of Manitoba

G. K. Yuill
Engineer
Unies Ltd.